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THE
GEOGRAPHICAL REVIEW

VOL. VIII SEPTEMBER, 1919 NO. 3

THE HANGING GARDENS OF THE MESA DE MAYA*

By CHARLES R. KEYES

Like an emerald solitaire, the hanging gardens of the Mesa de Maya are set in the tawny desert of our Southwestern tableland. A wonderful mass of verdure poised high above a boundless, waterless waste, this oasis is almost unique among the garden spots of earth, for it is mounted on a mile-high pedestal and is nearly 10,000 feet above sea level. Its even surface is richly fertile, intensely cultivated, and extraordinarily productive. Then, too, it is the home of a compact agricultural settlement which is as completely isolated from the rest of the world as if it were on an island in mid-ocean. Indeed, dwellers on the mesa look out upon the dreary monotonous sea of land about them as islanders do upon the ocean.

AN AGRICULTURAL EDEN

The existence of this community of thrifty and prosperous Northern farmers on the heights of a lonely rock in a Southwestern desert is really

* As explained in the article, the author uses "Mesa de Maya" as a collective term to designate the group of mesas which extend eastward from the Rocky Mountain front at the Colorado-New Mexico boundary, although the term strictly applies only to the most prominent, an eastern, member of the group. Selecting from the somewhat divergent nomenclature in the literature and on the maps the names that seem most appropriate, we obtain the following, proceeding from west to east (cf. map, Fig. 1): the Raton Mesas, consisting of Raton Mesa, Bartlett Mesa, and Barilla Mesa; Johnson Mesa; Chicorica Mesa; nameless mesa east of Emery Gap; Long's Mesa; Mesa de Maya; Fowler Mesa; and Mt. Carrizo. The mesa-top farms with which the article deals occur on the Raton Mesas, particularly Barilla Mesa, and on Johnson Mesa.

The sources on which the map, Fig. 1, is based are of unequal value. Only a third of the area is covered by the topographic sheets of the U. S. Geological Survey, and these are of different dates and scales; for the remainder resort has to be had to the maps of the earlier government surveys and to state maps. For the greater part of the United States this situation is still typical of that which confronts him who tries to represent, on other than general scales, a given part of its surface. The maps used are the following: (a) topographic sheets, 1:125,000, Spanish Peaks (surveyed in 1895), Elmoro (1895), Mesa de Maya (1890), Mt. Carrizo (1890); 1:62,500, Brilliant (1912-13), Raton (1911-12), Koehler (1915); (b) others: U. S. Geographical Surveys West of the One Hundredth Meridian (Wheeler Survey), topographic atlas sheet No. 70 (A), 1874-76; General Land Office map of New Mexico, 1:760,320 (1896 edition, with relief in hachuring; on latest, 1912, edition relief is in characterless hill-shading); Clason's Industrial Maps of Colorado, 1:650,000 (Denver, 1913), and of New Mexico, 1:750,000 (1908), for roads; Southern Pacific Company railroad map of the United States west of the Mississippi, 1:760,320 (1910), for railroads.—EDIT. NOTE.

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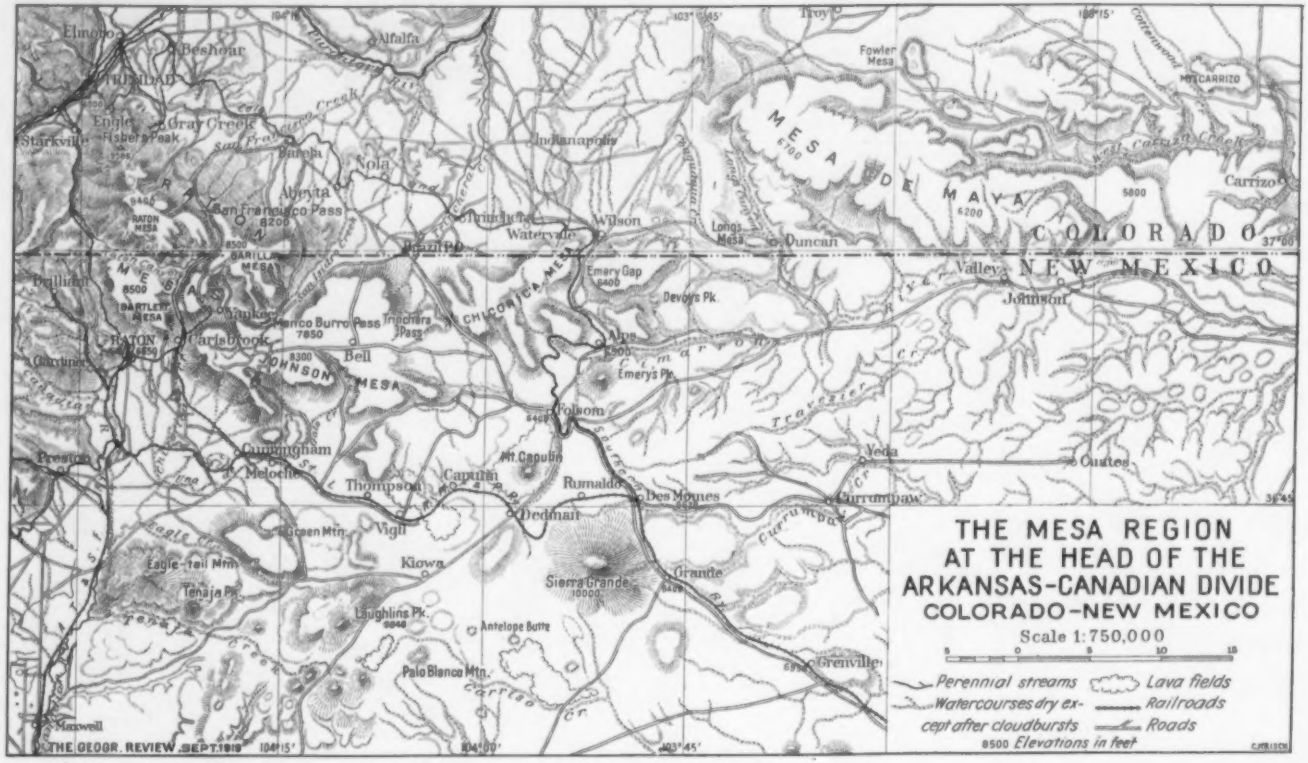

FIG. 1—(For sources see editorial footnote on preceding page.)

one of the agricultural marvels of our day and country. There, where a mile above the insufferable, barren waste is enjoyed the summer climate of the Upper Mississippi valley, are raised harvests of wheat and corn and oats more bountiful than in equal areas anywhere in the Northern States. Apple orchard and vineyard reproduce New England and New York. Vegetable patches surpass the truck lands of New Jersey and Maryland. It is the sole spot in all the vast Southwestern desert where irrigation is not resorted to in order to bring forth abundant crops. It is the western-most extension of Eastern gardens into the arid country, a last lingering trace of a bygone time before aridity spread its withering touch over the land.

Application of the Term Mesa de Maya

It will be necessary to explain in some detail the application of the term Mesa de Maya. The name itself is of Spanish origin and signifies "armored tableland" (*malle*=mail, armor), a typically apt term for a natural stronghold. Specifically it is applied to a single mesa of southeastern Colorado, but the term well describes a whole series of mesas of like origin, and physiographers, with an eye to the genetic aspects of the landscape, extend the title so as to include the whole of the former vast highland plain of which the present elevations are merest remnants.[1] These remnants owe their preservation to a thick capping of basalt. At Fisher's Peak, the most westerly extension of the mesas, the basalt has a maximum thickness of 500 feet. Of more or less columnar structure, it forms a sheer-walled brow to the table mountain, which thence falls by a steep declivity of 3,000 feet to the surrounding plains. The old plain of which these mesas are all but vanquished vestiges is inclined slightly to the eastward. At the Rocky Mountain front it has an elevation of about 10,000 feet above mean tide. On the Texas line, 130 miles away, it declines to about 5,000 feet above sea level.

Origin of the Mesa de Maya

The Mesa de Maya plain appears to have been of vast expanse in Tertiary time and to have formed the general upland surface of this part of the American continent. Of the old Tertiary peneplanation level little or nothing remains outside of the mesa tops. The attainment of its present high position is regarded as having taken place in Late Tertiary times. Since desert conditions began to set in about the same time there is every reason to believe that the magnitude of the erosion is represented by the difference between this old peneplane level and the present plains level—an interval of 5,000 or 6,000 feet, or something over a mile of thickness. There are also many considerations supporting the assumption that this area

[1] R. T. Hill: Physical Geography of the Texas Region. *U. S. Geol. Survey Topogr. Atlas of the United States*, Folio 3, 1900, p. 8.

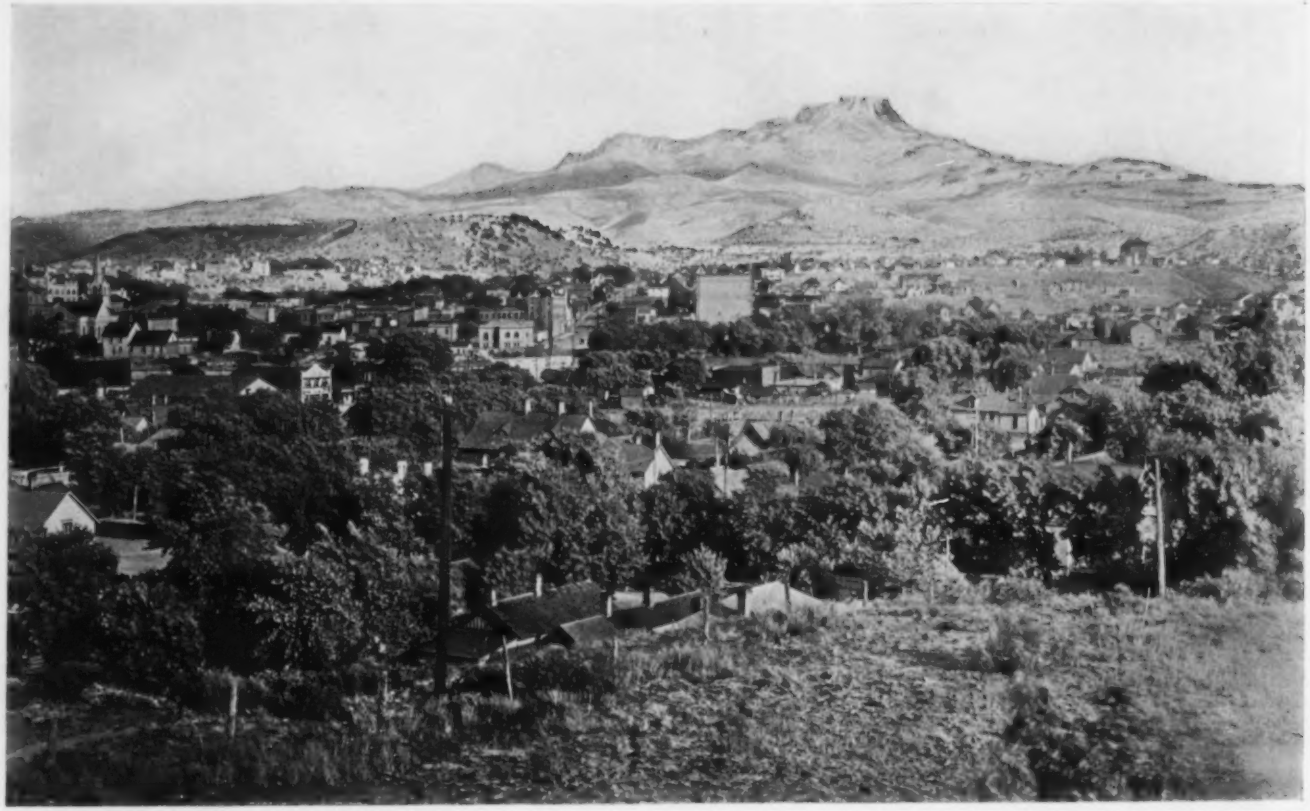

FIG. 2—Fisher's Peak, an outlying spur of Raton Mesa. Trinidad, Colo., in the foreground. (See also the view in *Geologic Atlas of the United States: Folio Elmoro* (*No. 58*), Fig. 2, U. S. Geol. Survey, 1899.)

before uplift was a vast plain and not a mountainous tract when the arid climate was inaugurated. The inappreciable aid of stream corrasion in this prodigious regional depletion is supported by the very prevalence of aridity itself. This region is one of the best extant demonstrations of the almost boundless potency of the wind in re-forming the face of the earth. The chief physiographic interest attached to the Mesa de Maya is, therefore, the novel manner of its depletion and the convincing evidence it affords of the tremendous potency and prodigious effects of eolian erosion. Nowhere else are the proofs of general land lowering through wind action better displayed.

The Wind-Eroded Landscapes

When once plainly discriminated, wind-graved landscapes are seldom mistaken for any other kind. Their individuality is very strong. Desert mountains rising abruptly out of the sea of earth around them impart the characteristic form of *inselberg* landscapes. The girdled mountains attest the vigor of natural sand-blast action and its maximum effectiveness at the plains level. Plateau plains of the desert manifestly represent former levels of the general plains surface. The notable absence of foothills, the frequency of rock floors, the smoothness of the wind-beveled surfaces are all unmistakable characteristics.[2]

The Mesa Gardens

In most arid lands the refreshing oasis is met with by descent into some hidden valley or gorge where the ground-water table reaches the surface. Thus invariably occur the oases of the Sahara. Of this nature, also, are the regions, famous in antiquity as the Gardens of the Hesperides, nestled under the beetling cliffs which form the border of the high, dry tableland of Cyrenaica. On the contrary, the gardens of the Mesa de Maya in their high-hanging situation are reached only after an arduous climb of a mile of elevation with a dozen miles of winding and twisting among bare rock.

Their elevation above sea level is not much less than 9,000 feet and they are therefore practically limited to the high mesas immediately south of Trinidad (see map). Fisher's Peak, an outlying spur of the Mesa de Maya, is, however, a point of faulty perspective. As viewed from Trinidad, ten miles away and 4,000 feet below, on the Atchison, Topeka and Santa Fé Railway, the flat summit is hardly apparent. To the gardens spread out over the top of the mesa the ascent is steep, a part of the wagon road near the end being blasted out of the living rock, where once was only the narrow trail of the mountain goat and of the fierce cougar.

[2] See several papers by the author, including: Competency of Wind in Land Depletion, *Monthly Weather Rev.*, Vol. 45, 1917, pp. 57-58; Deflative Scheme of the Geographic Cycle in an Arid Climate, *Bull. Geol. Soc. of Amer.*, Vol. 23, 1912, pp. 537-562; Deflation and the Relative Efficiencies of Erosional Processes under Conditions of Aridity, *ibid.*, Vol. 21, 1910, pp. 565-596; Lineaments of the Desert, *Pop. Sci. Monthly* Vol. 74, 1909, pp. 19-30.

The cool green paradise of the summit flat which suddenly presents itself as one reaches the end of the ascent is a most pleasing and surprising contrast to the insufferably hot and desolate desert that is left below.

Vulcanism and the Desert

The view over the desert from the Armored Table is extraordinary. To the more usual features of the desert are added the effects of vulcanism. Black basaltic rivers stretch out toward the horizon until lost in the

Fig. 3—Mt. Capulin, a recent ash cone in the volcanic district south of the mesa region. (Reproduced, by permission, from *Bull. Geol. Soc. of Amer.*, Pl. 81, Vol. 17, 1905.)

distance. Huge volcanoes studding the plains surface look like molehills on a lawn. Majestic Mt. Capulin is a recent ash cone compared with which that of Vesuvius sinks into insignificance. It rises 3,000 feet above the base and its gigantic caldron is half a mile across. It is perhaps the most perfect volcanic cone in existence. Local tradition places its last eruption within the century. Certain it is that snow falling on its flanks melts instantly. It is the most recently active volcano in the United States, Lassen Peak in California excepted.

Interesting as the desert landscape may be to the physiographer it is inexpressibly dreary to most travelers. "The scant grass is low, colorless, mossy, and of a perishing look; shrubs and soapweed are stunted, and the bony cactus writhes like some grisly skeleton; the very stones seem burnt to cinder. One vainly looks for the flight of a bird such as cheered the eyes of Thalaba in the desert; no bee nor fly hums in the empty air; and save the horned toad, the genius of desolation, there is no living thing. The place is the very battle ground of the elements. In winter it is made fearful by raging storms of snow and wind; in summer by the scorching sun or suffocating dust storm."

The Oasis and Its Natural Wealth

But let the traveler turn his gaze across the mesa. Instantly he is transported in fancy to some Northern farm scene, with its manifold evidences of bounty, thrift, and contentment. The billowy wheat just turning amber for the plentiful harvest, the waving corn, the broad green meadows with some of last year's hayricks still unused, the close-cropped pastures crowded with fat, contented herds, the trim young orchards with boughs already groaning under their burden of luscious fruit, and the kitchen

Fig. 4—View southwest from Mt. Capulin over the desolate volcanic district. (Reproduced, by permission, from *Bull. Geol. Soc. of Amer.*, Pl. 84, Vol. 17, 1905.)

gardens full of varied and useful vegetables dispel all thought of such things as deserts. In the midst of all are cosy, substantial cottages and capacious barns such as are characteristic of rural prosperity in the great farming states. Even spring-house and dairy are not wanting.

Where in all the world is a land of plenty more compactly displayed than on this high-hanging oasis of an American desert? The summer sojourner in Colorado is well repaid for a brief visit to this unique freak of nature. The winter traveler to California profitably breaks a long journey by a day off at Trinidad for a drive out to the sky farms. To the geographer and the student of man and his environment a visit to the high-perched gardens of New Mexico is an unforgetable revelation. If the hanging gardens of Babylon were one of the seven wonders of the ancient world, surely the hanging gardens of the Mesa de Maya are among the seven natural wonders of the modern world.

An unlooked-for factor that makes the Mesa de Maya all the more inhabitable and capable of wide industrial expansion is the presence of an

abundance of excellent fuel. In this almost treeless tract wood is scarce. Mineral fuel is plentiful. The entire mesa is underlain by thick seams of fine coal. Much of this coal is of the coking variety. Coke making is already a large industry at the foot of the mountains. Elmoro and Starkville coking ovens compare favorably with those of Connellsville, Pennsylvania. At present their output is used by the steel mills at Pueblo and by the smelteries generally throughout the Southwest and Mexico. One of the coal seams lies only a few feet beneath the lava cap of the mesa. Thus it chances that some of the highland farmers have coal mines in their back yards just as the thrifty New Englander has his woodpile.

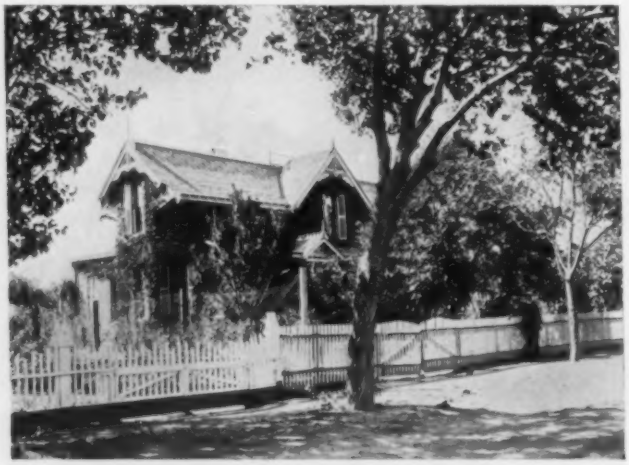

FIG. 5—A typical mesa-top farmhouse. The high elevation of the mesas, with their consequently greater rainfall, creates conditions akin to those of the Upper Mississippi valley or the Northern States in the midst of the Southwestern desert.

CLIMATIC EXPLANATION OF THE OASIS

After all, however, these high-hanging gardens of the Mesa de Maya are really not phenomena so anomalous as appears at first glance. They represent merely a specialized case of a widespread climatic feature of mountainous deserts. Throughout the mile-high desert range country with its torrid summer climate the two-mile-high mountain tops enjoy temperate conditions. Although the annual rainfall on the plains at the piedmont is only a few inches, on the summits it is frequently as much as 30 to 40 inches a year, about what it is in the Upper Mississippi valley.

The lofty Mesa de Maya differs from other desert ranges only in the circumstance that because of its peculiar geologic structure it possesses an extensive flat top enabling soil to accumulate and cultivation to take place, whereas other mountains are steep and bare and make farming precarious or impossible. Thus among geographic curiosities of the continent the great Armored Table stands without rival.

THE ANCIENT PIEDMONT ROUTE OF NORTHERN MESOPOTAMIA

By ELLEN CHURCHILL SEMPLE

The recurrent operation of geographic factors in history is nowhere more strikingly evinced than in the policies of commercial and territorial expansion directed toward the Mesopotamian Basin. Through the ages a long succession of Asiatic, European, and Egyptian powers have desired to control this natural transit land between East and West. Ancient Chaldean, Babylonian, and Assyrian kings pushed their frontiers from the Tigris west to the Mediterranean. Persian conquerors like Cyrus and Darius, incorporating in their expanding empires the coast land of the Levantine Sea, anticipated by two or three millenniums the present design of the British power in India to control this great diagonal land route from the Persian Gulf to the Mediterranean. History shows a like recurrent outreach from the West. Phoenicia, when Sidon was young, began the *Drang nach Osten* with the peaceful penetration of trade and the establishment of commercial colonies in Mesopotamia. The Pharaohs of the Eighteenth Dynasty, the Hittite power of Asia Minor, and the Greeks under Alexander the Great marched eastward as conquerors to the Euphrates bend and beyond. Rome's expansion over her military road through northern Mesopotamia anticipated the economic outreach of modern Germany over this strategic region. Nisibis was the easternmost outpost of the Roman Empire, and in 1918 it was the eastern terminus of the German-made Bagdad Railroad.

What are the geographic factors in this recurrent historical development, this drama which returns with monotonous action and theme, though the actors change in race, nationality, and civilization from one age to another?

Significance of the Mesopotamian Passway

The valley of the Tigris and Euphrates Rivers occupies a vast geographical trough extending diagonally across southwestern Asia from the Persian Gulf almost to the Mediterranean. It lies between the massive folded mountains of Persia and Armenia on the northeast and the plateau of the Syrian and Arabian Deserts on the southwest. Thus it forms a natural passway, flanked by two regions inhospitable to travel and transportation. It finds its eastern outlet through the Persian Gulf to the Indian Ocean, and its western outlet to the Mediterranean through a breach in the barriers of mountain and desert which form the eastern rim of the Levantine Sea. Except the Red Sea-Suez route, it has no effective competitor in the communication between East and West. The commercial significance of

the Mesopotamian passway lies in the fact that it links now, as it did 5,000 years ago, two regions of contrasted climates, contrasted products, and contrasted civilizations—the temperate European countries of the Mediterranean Basin and the tropical Asiatic lands of the Indian and Pacific Oceans.

Difficulty of Access from the Levantine Sea

Access from the Mediterranean to the Mesopotamian passage is difficult, except at one point (Fig. 1). The eastern sub-basin of the Mediterranean, known as the Levantine Sea, is surrounded on its three sides by natural barriers. Its northern coast is hemmed in by the high and rugged Taurus Mountains, which maintain a mean elevation of 6,500 feet but rise at intervals in serrated walls 10,000 feet or more. They effectually cut off the sea from the plateau interior of Asia Minor, except for the meager traffic which picks its way over the high-laid passes.[1] The southern littoral of the Levantine Sea borders the vast expanse of the Sahara and Libyan Deserts. Across this barrier only the long-drawn oasis of the Nile opens an avenue southward. On the east the Levantine Sea faces a multiple barrier which rises behind an inhospitable coast, with scarcely a harbor worthy of the name. Overlooking this unpromising littoral is a line of mountains and plateaus, stretching from the Amanus Range in northern Syria to the towering massif of Sinai (8,530 feet) in the south. These highlands are nearly everywhere steep and lofty enough, as in the alpine heights of Lebanon, or repellent enough, as in the rugged limestone plateau of Judea, to constitute serious barriers. Immediately behind the coastal highlands runs a long, narrow trough which sinks in the Jordan valley and Dead Sea 682 to 1,293 feet below ocean level. From the brink of this rift valley a second system of mountains rises parallel to the first, maintaining a mean elevation of about 2,500 feet in the south but rising to imposing heights in Mt. Hermon (9,020 feet) and the long wall of the Anti-Lebanon. East of Palestine this inner range is formed by the abrupt scarp of the Arabian Plateau. Though it rises to only moderate heights, it is a serious barrier, because the deep canyons of its drainage streams obstruct rather than facilitate the ascent from the Jordan trough. Beyond this second mountain system stretch the Syrian and Arabian Deserts, quite to the banks of the Euphrates.

Communications Across the Barrier

The Levantine Sea is therefore cut off from its eastern hinterland by double mountain walls with a moat between. Passage across this country is a series of ups and downs. The railroad from Jaffa up to Jerusalem (2,600 feet, or 792 meters) stops on the summit, discouraged from further

[1] D. G. Hogarth: The Nearer East, London, 1902, p. 36; Élisée Reclus: Géographie universelle, Paris, 1884, Vol. 9, pp. 470-479.

progress by the deep descent to the Dead Sea and the sharp ascent beyond to the heights of Moab. The railroad from Haifa follows a feasible route

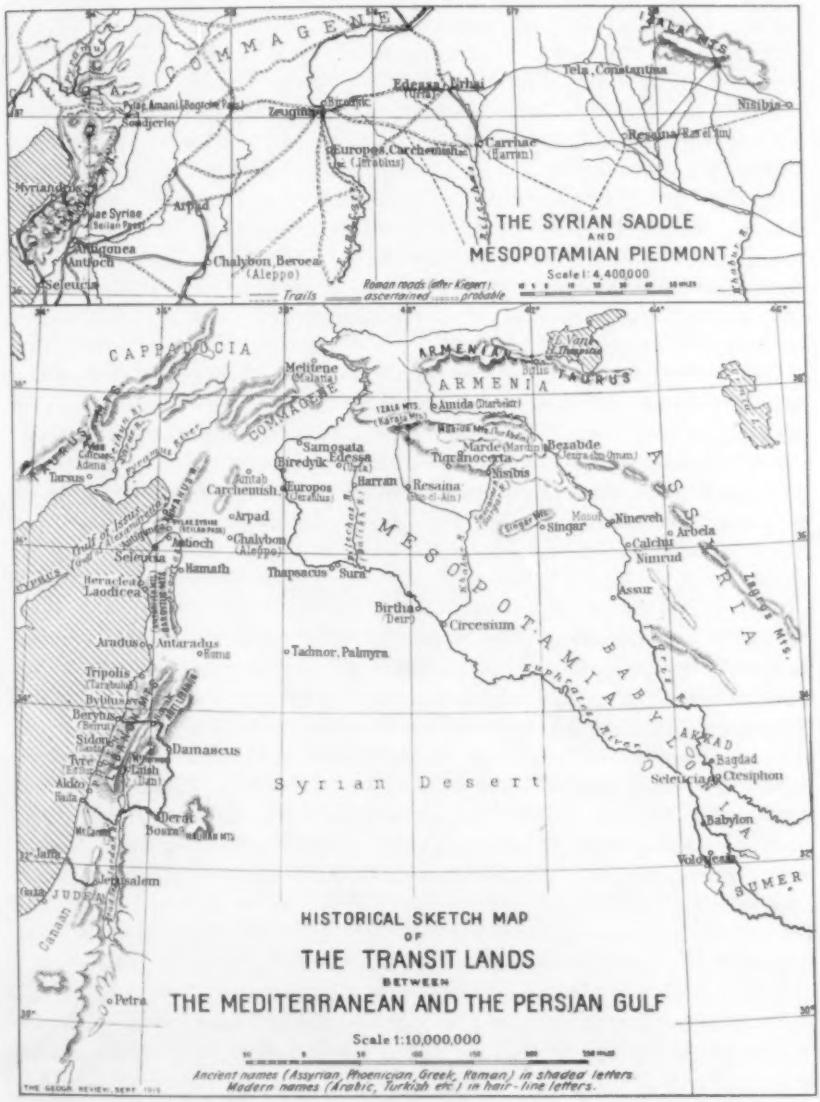

FIG. 1

eastward up the faulted plain of Esdraelon, along the track of an ancient highroad, to an elevation of 260 feet (80 meters), then drops down the

canyon of the Jalud to the Jordan River, which it crosses at 815 feet (249 meters) below sea level, mounts the Yarmuk canyon to Derat at 1,886 feet (575 meters) and, turning northward to its natural goal at Damascus, ascends at Kisweh to 2,425 feet (739 meters) before reaching its destination in the great desert metropolis at an elevation of 2,266 feet (691 meters).[2] The Beirut-Damascus railroad mounts the steep slope of the Lebanon Mountains from the sea by twenty miles of rack-and-pinion track, crosses the summit of the range at 4,880 feet (1,500 meters), drops to the intermontane trough at Rayak at 3,500 feet (1,070 meters), crosses the Anti-Lebanon at an elevation of 4,610 feet (1,405 meters), and finally descends nearly 2,400 feet to the plain of Damascus.[3] After all the vicissitudes of up-and-down transportation, with its attendant heavy costs, these transverse railroads come out on the economic void of the Arabian Desert, save where the old volcanic soil of the Hauran and the oasis of Damascus offer limited areas of tillage.

The ancient tracks which once served travel and trade picked their way painfully across these upheaved barriers, finding their difficulties complicated on the leeward slopes of the mountains by the scarcity of water for man and beast. In the long dry summers the danger of thirst threatened also on the western or Mediterranean slopes, except where the great height of the Lebanon insured unfailing springs.

The Suez-Red Sea Route

The eastern barrier of the Levantine Sea has, however, a partial breach at each extremity, which in all times has readily admitted traffic from the Mediterranean. To the south the barrier shrinks and drops to the Suez Isthmus, which affords a short and level passage to the Red Sea. In ancient times the Suez-and-Red Sea route to the Orient carried comparatively little traffic, even in the palmy days of the Roman Empire. Violent northwest winds in the Gulf of Suez and the upper half of the Red Sea, prevailing all year down to the 20th parallel,[4] a broad belt of coral reefs along the shores, desert coasts, and for the most part desert hinterland—all combined to make navigation dangerous for sailing vessels and to reduce the profits of commercial voyages. To avoid the perilous course of the upper Red Sea, ancient traffic made a long detour up the Nile River to Thebes and thence eastward across the desert by caravan to some lower Red Sea port. This was the prevailing route also through the Middle Ages. The Suez-and-Red Sea route became feasible only after the introduction of steam navigation, which made ships independent of wind systems.[5] Hence the isthmian canal, which from very ancient times was projected, begun, and dropped—

[2] Karl Baedeker: Palestine and Syria, Leipzig, 1912, pp. 140-145 and 240-242.
[3] *Ibid.*, pp. 295-298 and 300.
[4] Julius Hann: Handbuch der Klimatologie, Stuttgart, 1897, Vol. 3, pp. 76-77.
[5] M. Voss: Der Suez Kanal und seine Stellung im Weltverkehr, Vienna, 1904.

or constructed and then allowed to lapse into disuse again and again—first became profitable through steamer traffic.

The Syrian Saddle Route

A far more frequented route was that leading from the Levantine Sea through the northern breach in the barrier to the Tigris and Euphrates valley, and thence to the Persian Gulf. Where the Gulf of Alexandretta, the ancient Gulf of Issus, drives a marine wedge fifty miles back into the coast line of northern Syria, the mountain barrier contracts and drops to the single, relatively low chain of the Amanus Range, which forms a saddle connecting the tall and massive highlands to the north and south of it. This structural saddle, whose crest rises in general to 5,000 feet, was crossed in ancient times by three pass routes.

One led from the Cilician plain eastward up a tributary of the Pyramus River (modern Djihan) to the Pylae Amani, or modern Bogtche Pass, at about 3,000 feet, dropped thence down to the ancient Hittite town of Sendjerle near the modern settlement of Islahiya, whence it proceeded southeast over the plain to Chalyb or Beroea (Aleppo). This is the route of the modern Bagdad Railroad, which pierces the pass by a three-mile tunnel.

As originally projected, the railroad was to follow the second route over the Amanus Range, which was the established path of travel in the time of Alexander the Great. This route left the Gulf of Issus at Myriandros near the later Alexandretta, crossed the range by the Pylae Syriae, or Beilan Pass, at an altitude of 2,395 feet (730 meters), and descended thence to the plain of Aleppo at 1,215 feet on the east. This was Alexander's route after the battle of Issus in 332 B. C. and the most direct line of access to the Mediterranean for any modern railroad. The Macedonian army, approaching it from Cilicia along the narrow coastal road at the western foot of the Amanus Range, met the Persians drawn up to block their advance. The military German mind which built the railway saw in imagination this coast road bombarded by British ships and hence made the railroad take a long detour to the Bogtche Pass to the north.

Forty miles south of Alexandretta the Amanus Range is cleft by the gorge of the Orontes River, which cuts a passage to the sea. To the ancient Greek road builders this offered a feasible route of easy grade, only 21 miles long, from the Mediterranean up to the plain of Antioch and Aleppo. Early settlements, probably of Phoenician origin, at both entrances to the gorge, indicate that a rough track must have penetrated this passway in very ancient times. But it was the great pass city of Antioch and its port Seleucia which exploited their geographical position as the natural western termini of the great trade route to the East. Some day they may revive as railroad termini.

Behind the Amanus Range, where the Levantine mountain rampart is thus pierced and shrunken, the moat of the rift valley disappears; the inner mountain system runs out into low hills; and the last barrier formed by the Arabian and Syrian Deserts is superseded in this more rainy northern tract by a grassy plain, which with the Amanus Range fills the scant hundred-mile stretch between the Mediterranean and the great western bend of the Euphrates River. This plain receives from 10 to 20 inches of rain, enough to maintain ample herbage for the camels and horses of passing caravans and to support winter crops of wheat and barley. Furthermore, it is furrowed by small streams flowing down from the Taurus foothills to the north, whose waters have for ages irrigated the orchards and gardens of the big market towns scattered over this plain. Hence the ancients called it the Naharina, or "land of rivers."

This northern district of Syria therefore lets down nearly all the bars between the Mediterranean and the Euphrates. It may properly be called the Syrian Saddle, because here the multiple barrier of mountains and desert is reduced to a single low passage, which gives access to the great valley of the twin rivers, stretching away southeastward for 800 miles to the Persian Gulf.

The Euphrates as a Waterway

The Tigris-Euphrates trough varies in width from about 200 miles in the south to nearly 400 miles in the north, where the rivers emerge from the Taurus Mountains upon the plain. Except along its highland rim on the north and east, it has a rainfall so scant as to induce steppe or desert conditions over all its area. The alluvial tract of the lower valley was reclaimed to tillage and settlement only by irrigation. Northern Mesopotamia was a grassland in winter and early spring and a desert the rest of the year. The question now is: Where lay the main route of travel through this broad but arid trough?

At first glance the Euphrates River seems to afford the shortest and most obvious line of communication. And sure enough, we find that from the gray dawn of history (3000 B. C.) the river was utilized for the transport of cedar, cypress, and pine timber from the wooded slopes of the Amanus Range and the Lebanon,[6] and fine building stone and asphalt from upstream points, down to the head of the treeless delta and thence by canal over to the Tigris towns.[7] These bulky commodities were floated down the Euphrates on rafts buoyed up by inflated skins, like those depicted on ancient Babylonian and Assyrian monuments. The Euphrates, however, is a poor waterway and doubtless always has been. Gathering its main supply of water in its long mountain course in Armenia, it becomes navigable for rafts in the flood season from April to August. But when

[6] Fritz Hommel: Geschichte von Babylonien und Assyrien, Berlin, 1885, pp. 325-330; Hugo Winckler: Geschichte Babyloniens und Assyriens, Leipzig, 1892, pp. 43-44 and 56.

[7] E. Speck: Handelsgeschichte des Alterthums, Leipzig, 1900, Vol. 1, p 289.

the short winter rains are over, when the spring floods due to the melting of the mountain snows subside, when summer heat and irrigation further deplete the volume of water, the Euphrates reaches so low a stage between August and late winter that navigation is constantly interrupted by shallows and reefs.[8]

Ancient traffic on both the Tigris and Euphrates moved exclusively down stream.[9] The means of transportation were rafts and round wicker boats plastered with bitumen.[10] Such craft was unsuited to upstream navigation, especially in view of the swift current, which above the deltaic lowland runs four miles an hour in flood time. This was the season of navigation because the awkward boats were swept down stream to their destination by the rapid current and escaped the danger of shipwreck on the rocky reefs. Herodotus indicates that the Euphrates River was a common route for passenger traffic from the Mediterranean to Babylon.[11] In Pliny's time it took ten days to make the voyage down the river from a point near the mouth of the Balikh to Ctesiphon, the Parthian capital.[12]

The Euphrates has never invited the development of a busy highway along its banks. It flows through Mesopotamia but does not water it. Its swift stream lies at the bottom of a narrow, cliff-faced intervale, hardly accessible to the nomads on the plains above. Occasionally, where the cliffs recede and admit a broader strip of alluvium along the banks within reach of irrigation from *shadûf* and water wheel, villages with cultivated fields and date palms appear. The sparse sedentary population along the Euphrates, the meager products of the arid country, the scant local commissariat for caravan or army, and the constant danger of nomad attack or blackmail[13] combined to discourage ancient travel along the river above the delta, which marked the beginning of the dense population.

The Euphrates Valley as a Military Route

Among all the military campaigns conducted by would-be conquerors between Babylonia and the Syrian coast during 2,000 years or more, only one, so far as we have been able to discover, followed the route along the Euphrates. That was the expedition of Cyrus the Younger in 401 B. C., who took the shortest road to Babylon in order to surprise Artaxerxes before he had news of the revolt. The description of that journey in Xenophon's Anabasis shows this to have been no route for armies which had to live off the country. On the desert stretch below the mouth of the Khabur River, a thirteen days' march, many of the baggage animals perished from hunger, and some of the soldiers subsisted entirely upon the

[8] Meyers Konversations-Lexikon, article "Euphrat."
[9] J. L. Myres: The Dawn of History, London and New York, 1911, pp. 95-96.
[10] Herodotus, Bk. I, Ch. 194.
[11] *Ibid.*, Bk. I, Ch. 185.
[12] Pliny: Historia Naturalis, Bk. 5, Chs. 26 and 89.
[13] Strabo, Bk. 16, Ch. 1, § 27.

meat of the antelopes and wild asses grazing on the plains. At times it was necessary to prolong the day's march in order to get water and fodder. The few settlements on the river made a living by quarrying millstones which they sold to Babylon for grain.[14] A Roman campaign, which was planned in 242 A. D. to invade Parthia by the Euphrates route and capture Ctesiphon, proved abortive owing to the lack of food. The army reached Circesium at the mouth of the Khabur River but, failing to find there the store of provisions which it had expected for the long desert stretch of the march, mutinied and turned back.[15]

Caravan Routes

Caravans, carrying their own food supply, followed a variant of this route many miles east of the river. They must have been confined to winter and spring, when their camels could find forage. Possibly the caravan traffic of the cooler months was supplemented by river traffic during the hot summer, when navigation was good but desert travel particularly bad. In the time of Augustus, "the road of the merchants," as Strabo calls it, to Ctesiphon or Seleucia on the lower Tigris started from the Euphrates bridge at Europos (Hittite Carchemish and modern Jerablus) and led thence for twenty-five days southeast through the steppes and deserts of the nomad Scenitae, or tent dwellers, who gave the caravans safe passage for a moderate transit duty and furnished them with water drawn from local wells or brought from a distance.[16] The route along the river was avoided because of the exorbitant dues exacted by the tribes dwelling along the stream. At a later date (51 A. D.) a Parthian king evidently succeeding in suppressing or controlling this evil, because be attracted to his *entrepôt* of Vologesia and other towns on the lower Euphrates the trade which reached the upper river from Damascus. This Syrian metropolis maintained connection with the Euphrates by a desert trail running through a series of oases strung along the foot of a ridge to Tadmor,[17] and thence east to Birtha (modern Deir) near the mouth of the Khabur River, or north to Sura, located on the Euphrates between Thapsacus and the mouth of the Balikh. During the second and third centuries A. D. Palmyra, or Tadmor, as way station between the Euphrates and Middle Syria, enjoyed a short-lived prosperity which rose and declined with this caravan trade to the Persian Gulf.[18]

Desert Routes

Traffic on a small scale doubtless dribbled into Babylon and Damascus straight across the desert ever since those early days when "the Princes of

[14] Xenophon: Anabasis, Bk. I, Chs. 4 and 5.

[15] Theodor Mommsen: The Provinces of the Roman Empire from Caesar to Diocletian, New York, 1887, Vol. 2, pp. 98-99.

[16] Strabo, Bk. 16, Ch. 1, § 27.

[17] D. G. Hogarth: The Nearer East, p. 135; Ellsworth Huntington: Palestine and Its Transformation Boston, 1911, pp. 337-340.

[18] Mommsen, *op. cit.*, Vol. 2, pp. 50, 69, 101-102, and 106.

Kedar'' brought in lambs and rams from their meager pastures for the markets of ancient Tyre. The nomads were the natural middlemen and carriers in this desultory trade. In their normal course of life, they drifted down to the marsh meadows of the lower Euphrates in summer, when their water holes were dried up and their pastures burnt bare, then back again to the desert when the winter rains revived the herbage, and on to towns of the desert fringe like Damascus and Bosra,[19] to barter the products of their herds and their slender stock of Babylonian merchandise for grain and arms—the wheat of Bosra and the steel of Damascus. The Babylon and Damascus trail doubtless followed the modern caravan route. The desert junction of Petra, which traded with Gaza and Egypt, imported nothing from Babylonia, so far as the evidence shows, but only the rare products of Arabian Yemen together with the Indian and African commodities brought to Aden (Adane) and Mocha (Muza). These goods were carried from the southern ports up the Red Sea to Leuce Come (about latitude 24° N., near the modern Janbo) on the Arabian coast during autumn and winter, when the southeast monsoon was blowing. There they were transferred to caravans for transportation to Petra. The route probably followed approximately the line of the Hejas Railroad from Medina to Maan. It was impracticable for an army, so the Nabataean guide maintained who advised that the Roman campaign against this country in 25 B. C. should move by sea. The guide was made the scapegoat of an unsuccessful expedition and charged with treachery by Strabo,[20] who with biased judgment reasoned that the route was feasible for large caravans and therefore for an army of over 10,000 men. Only this trade in aromatics, goods of small bulk and large value like frankincense, myrrh, cinnamon, and perfumes,[21] could stand the heavy cost of desert transportation. Fodder and water had to be purchased all along the way, and transit dues had to be paid in addition to the imperial Roman customs. Guards had to be employed then as now to protect the caravan against the robber nomads. Pliny reckoned the total cost of carriage for a camel's load of frankincense from Leuce Come to Gaza at 688 denarii, or $150.[22] Only the wealth and luxury of the Roman Empire could have supported this caravan trade on a large scale; and even so it must be remembered that the major part of these Oriental luxury articles reached Mediterranean ports by the Red Sea-and-Nile route to Pelusium or later to Alexandria.[23]

The Route of Ancient Military Commanders

Diligent research discloses no evidence that desert routes ever forwarded a large amount of trade or were ever traversed by an army. The

[19] Mommsen, *op. cit.*, Vol. 2, pp. 169-170.
[20] *Ibid.*, pp. 316-317, footnote 2.
[21] Strabo, Bk. 16, Ch. 4, §§ 19, 23, and 24.
[22] Pliny: Historia Naturalis, Bk. 12, Chs. 14 and 65.
[23] Strabo, Bk. 16, Ch. 1, § 24.

nearest approach to such a venture was that of the Babylonian prince Nebuchadnezzar in 605 B. C. He was in southern Palestine about to pursue the forces of Pharaoh Necho into Egypt, when he learned that his father, Nabopolassar, had died. Fearing a pretender might arise, to save time he hurried across the Arabian Desert to Babylon with a small band of followers; but he sent his army by the circuitous route around by the Naharina, the western bend of the Euphrates, and northern Mesopotamia by which he had come.[24] Countless conquerors before him had traveled this road, whether they marched east or west.

This was the route of Alexander the Great. Moving north after his conquest of Egypt and Phoenicia, he crossed the Euphrates at Thapsacus in August 331 B. C. for the invasion of Mesopotamia. He did not take the short way down the river to Babylon, but struck north up the Balikh valley and then east along the piedmont of the Taurus foothills to the Tigris River, because this route offered the easiest line of march, provisions for his men, and fodder for his animals; so Arrian, his chronicler, tells us.[25] In Mesopotamia a food supply big enough for a large army and its transport in late summer pointed to irrigated fields, a sedentary population, and considerable towns. These were conditions which attracted ancient armies and traders to this route. They attracted also the German promoters and engineers who projected the modern Bagdad Railroad.

Antiquity of This Route

As far back as we can penetrate into the remote past, we find that the main line of communication from the Persian Gulf to the Mediterranean followed a land road east of the Tigris along the base of the Persian highlands north to Assur or Nineveh near modern Mosul, ran thence westward along the piedmont of northern Mesopotamia to the great western bend of the Euphrates, which it crossed by ford or ferry according to the place and time of the year. Thence it continued west past Chalybon (Aleppo) to the Mediterranean by the Amanus passes or by more devious and difficult tracks farther south. From Aleppo eastward to Mosul this is the route of the Bagdad Railroad, which between Mosul and Bagdad follows the level west bank of the Tigris to avoid engineering difficulties and reduce operating expenses. Many of the stations on or near the railroad, like Nisibis, Ras-el-Ain (Resaina), Harran, Jerablus (Carchemish), and Aleppo meet us at the beginning of history. They have seen the encampment of royal Babylonian armies 2000 or 3000 B. C., and they have watched the sheik Abraham pitch his tents by their wayside waters, as he drifted westward with his clan towards the land of Canaan.[26]

[24] G. C. C. Maspero: The Passing of the Empires, New York, 1900, p. 518; George Rawlinson: The Five Great Monarchies of the Ancient Eastern World, New York, 1870, Vol. 3, p. 49, footnote 16.

[25] Arrian: Anabasis of Alexander, Bk. 3, Ch. 7.

[26] Genesis, xi, 31: xii, 4-5.

Climatic and Geographic Reasons for This Route

This ancient route between the Syrian Saddle and the Tigris highway finds its explanation in the climatic and geographic conditions of northern Mesopotamia. These have determined the distribution of settlements and the main lines of travel in this semi-arid land. Mesopotamia is a region of meager winter rains and long summer droughts. The dry season falls in the hottest part of the year, when great heat prevails over the plains and evaporation is intense. The precipitation from May to November is practically nil, and even in the cold season it is scant. The plains from the Persian Gulf north to the 36th parallel get less than 8 inches, or 200 millimeters, of rain[27] (Fig. 2). From this line northward precipitation in-

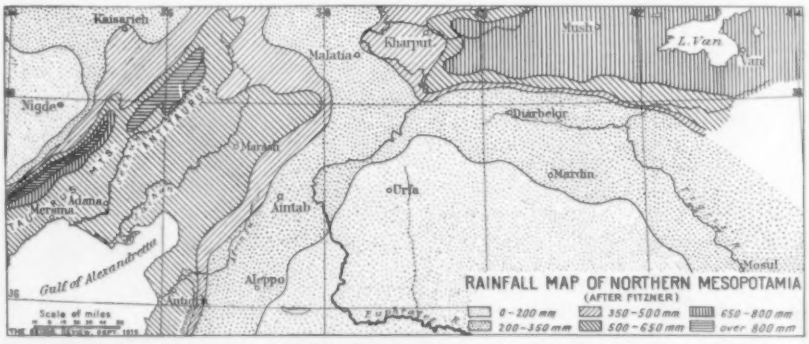

Fig. 2—(Based on source cited in footnote 27).

creases owing both to the more northern location and the higher elevation of upper Mesopotamia. The increments, however, are very small. The line of ten inches (250 millimeters) annual rainfall describes an arc subtended by the 36th parallel, with one extremity 30 miles southeast of Mosul and the other at Aleppo, while the curve runs up the Tigris River and along the crest of a series of highlands which form an outlier of the Taurus system and wall in the plains of Mesopotamia on the north.

The Urban Belt

These highlands consist of the Tur Abdin (ancient Mt. Masius), a long narrow plateau of 3,300 to 4,000 feet elevation with a steep escarpment to the south, and the Karaja Mountains (ancient Mt. Izala), an old volcanic massif which maintains a general altitude of about 4,100 feet, but rises to 6,068 feet in its culminating peak, only to sink westward towards the Euphrates bend in an undulating upland 2,600 feet above sea level.[28] These massive foothills of the Taurus are high enough to wring some mois-

[27] Rudolf Fitzner: Niederschläge in Klein-Asien, *Petermanns Mitt. Ergänzungsheft No. 140*, 1896, p. 90, rainfall chart.

[28] Hogarth, *op. cit.*, pp. 62, 91, and 97.

ture from the reluctant clouds. In winter they accumulate snow enough on their upper slopes to form a considerable reservoir of moisture; and in the spring they drop a fringe of slender torrents down to the plain. Their irrigating streams through the ages have reclaimed the northern border of the Mesopotamian steppe from pastoral nomadism and stretched a piedmont belt of towns, surrounded by well-watered gardens, orchards, vineyards, and fields, to link the settlements on the Tigris with the western bend of the Euphrates and the Syrian Saddle.

The breadth of this urban belt, the density and prosperity of its population, has generally depended upon the strength and sanity of the ruling governments, whether in Babylon, Nineveh, Antioch, Rome, or Bagdad. Its northern edge in ancient times, as in modern, was pushed well up into the highlands to an altitude of about 2,000 feet at Urhai or Edessa (modern Urfa), at the ancient Babylonian Tela near the later Roman Constantina and modern Veranshehr, as later in the first century B. C. at the Armenian capital of Tigranocerta, whose mound of ruins lies beside the modern Koihissar; and at Marde (modern Mardin) it climbed the steep slope of Mt. Masius to 3,050 feet. These upper towns enjoyed comparative immunity from nomad raids from the steppes, while they commanded numerous springs and an assured water supply. However, in Mardin in the twelfth century every house had its cistern for storing rain water;[29] ancient cisterns everywhere indicate the economy practiced.

The downstream settlements of this urban belt, like Harran or Carrhae, Resaina or Ras-el-Ain, and Nisibis, lay only about 1,400 or 1,500 feet above sea level; though more precariously located as to water supply and nomad attack, they nevertheless occupied a better position for trade. They were stations on the great piedmont route between the Tigris and the Euphrates, which was a type of all such roads in semi-arid lands. It marked the nice adjustment between the farthest encroachment of the desert uphill in the dry season, and the farthest assured reach desertward of the irrigation streams from the mountains behind. North of this line, where the slope from the marginal highlands was steeper, the deeper valleys cut by the swift drainage streams and the more rugged character of the country presented obstacles to transportation.

Seasonal Deviations from the Established Route

It must not be supposed, however, that the ancient route never deviated from this line; that would be contrary to the nature of primitive roads in grasslands. In the late summer, when the interfluvial spaces were parched and the water holes dry, especially when a succession of almost rainless years had expanded the domain of the desert, then army or caravan would take a parallel path farther north, near the upper edge of the urban

[29] Guy Le Strange: The Lands of the Eastern Caliphate, Cambridge, 1905, p. 97.

piedmont belt. It would cross the Euphrates at Biredjik, one of the most important crossing places of the river from time immemorial, site of the Greek Zeugma or bridge,[30] and turn thence east to the ancient Greek Edessa and yet more ancient Aramaic Urhai. Then, passing numerous villages, now heaps of ruins except for their ancient cisterns which still serve travelers till late summer, it would go eastward through the upper hill towns till it reached ancient Marde. This upper track, maintaining a general level of 2,000 feet, was nearer the springs that fed the streams and offered better pasturage for the pack animal. From Marde, however, it dropped down to Nisibis, which lay on the Gargar, the last perennial stream. Few of these piedmont rivers outlive the summer drought and the tax of irrigation. The Gargar, which still waters the gardens and fields of Nisibis, is sometimes 20 feet wide in August and too deep to be crossed except at fords.[31] Nisibis was therefore always a station on the piedmont route.

In the dry season the track continued eastward, hugging the foot of the Tur Abdin escarpment with its fountains and wells all the way to the Tigris gorge at ancient Bezabde (modern Jezira-ibn-Oman). This was the road taken by Alexander the Great in the summer of 331 B. C. An eclipse of the sun fixes the date when he crossed the Tigris as September 20, the climax of the dry season.[32] However, after the winter rains had carpeted all northern Mesopotamia with grasses and flowers, the main route turned southeastward, about 20 miles east of Nisibis, and struck out straight towards Nineveh across an arid stretch of 30 miles, until it met the wadis draining northeastward from the Singar Mountains to the Tigris. This is the path of the Bagdad Railroad from Nisibis to Mosul. So stable is the geography of communications in these semi-arid lands. Yet another variant, feasible in spring for armies, turned west from Nineveh and followed the southern base of the Singar Mountains, whose barrier was high enough to make the passing winds pay a toll of water; then bent north through a gap in the range to Nisibis,[33] crossing the sheaf of wadis which united to form the Saocaras River (modern Gargar). This route was less favorable for caravans than for armies because it was exposed to nomad raids.

Historical Emergence of the Piedmont Route

Historical evidence shows that the Mesopotamian piedmont was the chief link between ancient Babylonia and the West. This is indicated by the persistent trend of Babylonian and Assyrian expansion westward along this piedmont, especially after 1500 B. C., when we begin to get reliable accounts of the wars for the control of northern Mesopotamia. The need

[30] Strabo, Bk. 16, Ch. 1, § 23.
[31] Max von Oppenheim: Vom Mittelmeer zum Persischen Golf, Berlin, 1900, Vol. 2, pp. 26, 31, and 256.
[32] Arrian, *op. cit.*, Bk. 3, Ch. 7.
[33] G. C. C. Maspero: The Struggle of the Nations, New York, 1897, p. 643.

of lumber in the treeless lands of the delta was the original motive which induced the early kings like Sargon of Akkad (2500 B. C.) to conquer the well-wooded mountains of the northwest and to extend their dominion over "the lands of the sunset sea,"[34] as the cuneiform records call the Mediterranean. The Euphrates River may have been the original outward line of exploration, as it undoubtedly brought down to Babylon the bulky exports from the Amanus and Lebanon forests;[35] but the piedmont route early begins to emerge in the movement of armies, the spread of commerce and religions. The names of its cities appear in early Babylonian history—Assur, Singar, Nisibis, Tilli or Tela, and Harran.[36]

Harran and Its Importance

Harran or "Road Town", located on the Bilechas River (Balikh) on the trunk route of northern Mesopotamia and at the focus of tracks radiating fanwise to the several fords of the Euphrates elbow, was the most important and influential city of all this region.[37] Of independent origin, reputed by tradition to be the first town after the Flood,[38] it became the western outpost of Babylonian civilization. By the tenth century B. C. it was a capital of Assyria co-equal with Assur itself. It was the seat of the ancient moon cult, which spread thence to Babylonia at a very early date and which later colored the religious life of Assyria to the east and of Phoenicia, Syria, and Palestine to the west.[39] Many of the foreign cultural influences apparent in Syria and Palestine emanated from Harran rather than from Assyria, to which they have been attributed. Contrarywise, many Occidental influences which can be discerned in the cults of Babylonia spread to the lower Tigris by way of Harran. The Syrian weather god Rammon is domiciled in Babylon by 2000 B. C., and he is worshipped in Assur on a par with the local god Assur in 1800 B. C. The goddess Ishtar, or Astarte, or Astaroth, was chief deity of Nineveh and Arbela in Assyria. Her worship spread thence westward along the piedmont to Phoenicia, Cyprus, and western Asia Minor along the routes of Phoenician traffic in the second millennium B. C.[40]

Phoenicia early secured her trade connections with the piedmont belt, because this opened up her most productive hinterland.[41] She did this by means of inland colonies or trading stations, located at strategic points along established routes. Laish, or Dan, a Sidonian colony of the fifteenth century B. C., situated at the sources of the Jordan River, gave access to

[34] Eduard Meyer: Geschichte des Alterthums, Berlin, 1913, Vol. 1, pp. 420 and 519-520.
[35] Hommel, *op. cit.*, pp. 328-330.
[36] Maspero: The Struggle of the Nations, p. 26.
[37] R. W. Rogers: A History of Babylonia and Assyria, New York, 1900, Vol. 1, p. 300.
[38] Le Strange, *op. cit.*, p. 103.
[39] Eduard Meyer, *op. cit.*, Vol. 1, pp. 420, 519-520, and 606; Winckler, *op cit.*, pp. 148-149.
[40] *Ibid.*, pp. 168-171.
[41] Wilhelm Götz: Die Verkehrswege im Dienste des Welthandels, Stuttgart, 1888, pp. 95-97; Maspero: The Struggle of the Nations, pp. 193-194.

the old military road which led north through the Lebanon trough[42] to the Euphrates bend. Hamath, of supposed Phoenician origin, was a station on the Orontes road, and Thapsacus, at the Euphrates ford, commanded the trading advantages at the crossing of the river. Nisibis, claimed as a Phoenician foundation because of its name,[43] was probably rather the seat of a Phoenician commercial factory which introduced there the wares and religions of the West. Harran participated actively in the markets of Tyre in Ezekiel's time[44] and doubtless much earlier when it was an important independent city and middleman between West and East. All Syria and Palestine evidently regarded the piedmont route as their chief line of communication with Babylonia and Chaldaea. According to Jewish legendary history, it was from Harran on this old trunk road that Abraham and his nomad tribe moved westward to Canaan.[45]

Commercial Value of the Mesopotamian Piedmont

The Mesopotamian piedmont of town and highway extended west to the great bend of the Euphrates. There it joined the populous plain of Naharina and the Syrian Saddle, which together were the focus of trade routes radiating north, west, and south. One well-traveled road led up from Egypt along the narrow land bridge between the Mediterranean waste of water and the Arabian waste of desert sands. Another ran northwest across the Cilician plain and over the Pylae Ciliciae, or Cilician Gates, in the mighty Taurus range to the Hittite country on the Halys River in Asia Minor, where it connected with tracks leading west to the Aegean Sea. Yet another ran north from Harran through Urfa and Samosata at the passage of the Euphrates to Melitene (Malatia), where it connected with the main road through Asia Minor to the Hittite country. Besides these land routes, dissolving Mediterranean trails, whose signposts were the stars, brought Phoenician cargo ships from Egypt, Crete, and other Aegean lands and contributed rare oversea products to this focal market region.

The commodities meeting here for exchange were varied—pearls, jewels, and spices from India; embroidered garments and imitation lapis lazuli from Babylonia; gums, perfumes, drugs, and frankincense from Arabia; linen, goldwork, and inlaid ivory from Egypt; horses, cattle, and metals from Armenia and the northern mountains; sheep, goats, fruits, and wine from the piedmont towns of Mesopotamia; olive oil, wines, copper, and Tyrian purple from the Mediterranean lands, besides the beautiful manufactured wares of the Phoenician cities.

All these routes with their richly laden caravans converged upon the cities strung along the western bend of the Euphrates from Thapsacus to

[42] Judges, xviii, 7 and 28; F. C. Mövers: Die Phoenizier, Berlin, 1850, Vol. 2, pp. 136 and 160.
[43] Mövers, *op. cit.*, pp. 161-165.
[44] Ezekiel, xxvii, 23.
[45] Genesis, xi, 31; xii, 5.

Samosata and those scattered over the plain between the river and the foot of the Amanus Range. Each city became a market because it was a necessary stopping place. It commanded a ford or ferry across the Euphrates, which involved a halt until all the long caravan should have safely crossed; or it supplied water to the merchant and his transport from the stream which irrigated its gardens and orchards. This was a desirable district. It offered

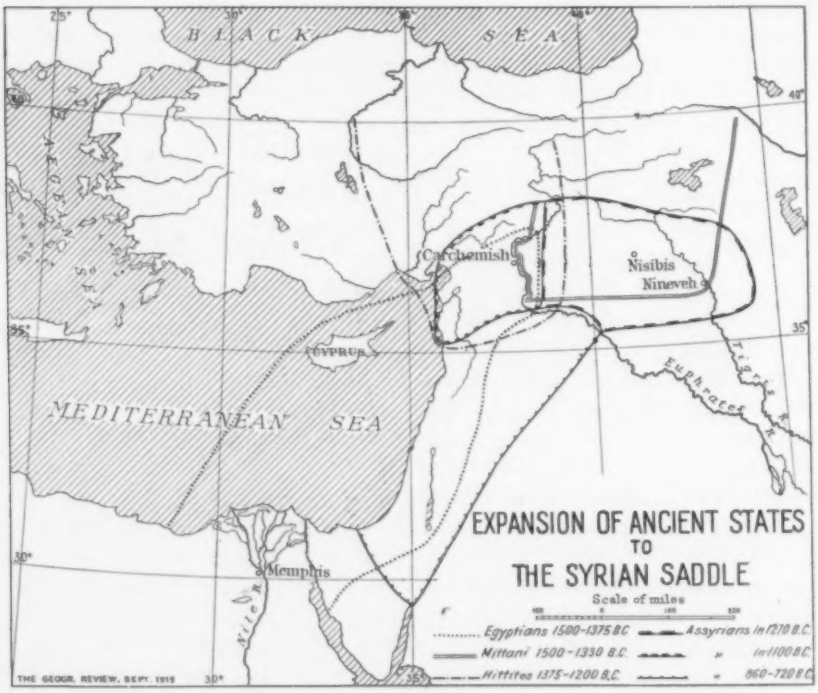

FIG. 3

big profits to the trader and big revenues to the government. Its towns were inhabited by merchant princes of vast wealth. Azaz, Arpad, Pethor, Chalybon (Aleppo), and Carchemish yielded rich booty or ransoms to the conqueror.[46] Hence this whole region early became the object of conquest from every side, while the Mesopotamian piedmont belt, which linked it with the tropical East, was hardly less the goal of expansion. Every contiguous power, no matter how small or unorganized, tried to set up its toll-gate on this great highway. A map of the series of conquests in this region from 1600 B. C. to the Crusades (see Fig. 3 for the period 1500-720 B. C.), and again through the modern period, shows all the great historical episodes to have been cast in the same mold; and this mold in turn was

[46] Rogers, *op. cit.*, Vol. 2, pp. 64-65 and 75, footnote 2; A. H. Sayce: The Hittites, London, 1890, pp. 46-47.

fashioned by the geographic conditions. The artificers were in turn of all races, tongues, religions, and cultural development; but their hands knew only the one cunning when it came to turning out historical events in this region.

Babylonian Struggle for Trade Control

Babylon, as we have seen, claimed suzerainty over the Syrian Saddle and the piedmont belt from about 3000 B. C. From the time when Sargon of Akkad made his expedition against the Amorites of the Orontes valley in 2500 B. C., Babylonian influences were strong throughout northern Syria,[47] disseminated there by caravans traveling either by the Euphrates track from Babylon or by the piedmont route, which apparently got most of the traffic. The Babylonian king Kadashman-Kharbe (c. 1450 B. C.), finding himself excluded from the piedmont road by Assyria's occupation of northern Mesopotamia, undertook to open a road across the Syrian Desert. He subdued the nomad Suti dwelling about the mouth of the Khabur River, made wells, erected military posts, and established Babylonian settlements along the way, which probably ran through Tadmor to Damascus. By this route, which was shorter and avoided the long detour to the north, he hoped to divert the western trade from Assyria, which was expanding along the piedmont to secure this very trade.[48] The desert road was apparently a failure, for very soon Babylonia is again fighting Assyria for the control of northern Mesopotamia, and keeps up the conflict for centuries.[49]

The Relation of Nineveh to the Piedmont Route

Assyria, owing to her geographic location, had a dominant interest in the traffic which moved along the piedmont belt to and from the Mediterranean ports. The cities of Assur and Nineveh, situated on the upper course of the Tigris at the head of regular navigation, were the eastern termini of the piedmont route. There goods were transferred from caravan to *kelek* for transportation downstream to Babylonia; or they went north to the fertile Lake Van district (Lake Thospitis) of Armenia by a road up the Tigris valley and over the Taurus Mountains by the Bitlis Pass (5,000 feet), the route followed later by Xenophon's retreating army. Yet other wares went east through Arbela and over the passes in the Zagros Mountains to Media.[50] Thus Nineveh, like Carchemish on the Euphrates, was a river town at the focus of land routes. Geographical location made it the natural middleman between East and West, stimulated commercial and territorial expansion, and impelled it especially to secure

[47] Eduard Meyer, *op. cit.*, pp. 389 and 601-604.

[48] Hugo Winckler: History of Babylonia and Assyria, transl. and edit. by J. A. Craig, New York, 1907, pp. 82-83.

[49] *Ibid.*, pp. 84-85 and 93-94.

[50] Winckler: Geschichte Babyloniens und Assyriens, pp. 147-148.

control of the piedmont route to the west. Hence Nineveh drove out all competitors and monopolized the profits. Finally, she seized the fords of the Euphrates at the great bend and controlled the highroads to the Phoenician ports. The process of western conquest went on for seven centuries with alternating success and failure; but it was not relinquished until Nineveh fell to Median attacks in 607 B. C.

The Development of Assyria

"The land of the city of Assur," the original Assyria, was a colony or vassal state of Babylon;[51] but it developed differently from the motherland, owing to geographic conditions. It was poor in irrigable plowland, and for this reason also turned to commerce. Its more northern location, its relatively cold winters and prevailing mountainous relief tended to produce a more enterprising and energetic population than was to be found on the low alluvium of Babylonia. Moreover, the people were probably a pure Semitic stock, unmixed with the Sumerian blood which diluted the Semitic strain in the deltaic lowland. Hence Assur developed a different type of people with different interests.[52] It became a typical colonial frontier state, with a natural tendency to political defection born of remoteness, contrasted conditions, and divergent interests.[53] So it set up an independent government some time between 1800 and 1500 B. C. When the kingdom of Assyria expanded, it spread northward and westward along the lines of least physical resistance and greatest commercial opportunity. It never for any length of time transcended the Zagros Mountains to the east or the main Taurus range to the north. Its military campaigns in these directions seem to have been primarily defensive or punitive, designed to protect its own borders, while those towards the west reveal a sustained policy of expansion which had for its goal the littoral of the Levantine Sea. The cost of these campaigns was amply covered by the enormous booty, ransoms, and tributes secured from the piedmont cities which studded the main line of march from the Assyrian frontier to the Phoenician ports.[54] The treasure in these cities, varied and abundant as it was, could not have been derived from the rather meager local resources of the district and therefore bears evidence to the immense profits procured from the passing trade.

Thus the little "land of the city of Assur" of 1500 B. C. expanded into the vast Assyrian Empire. The capital shifted upstream from Assur to Calchu, or Nimrud, in 1300 B. C., and in 1100 B. C. yet farther north to Nineveh, whose ruins lie opposite the present city of Mosul. Nisibis, owing to its location near the eastern end of the piedmont route, became an early

[51] Winckler: Geschichte Babyloniens und Assyriens, pp. 144 and 153-154; G. C. C. Maspero: The Dawn of Civilization, New York, 1901, p. 564.

[52] Rogers, *op. cit.*, Vol. 2, p. 308.

[53] E. C. Semple: Influences of Geographic Environment, New York, 1911, pp. 234-238.

[54] Rogers, *op. cit.*, Vol. 2, pp. 64, 65, 75-76, 81, 96-97, and 225.

outpost of Assyria when that state in the fourteenth century began to expand westward through northern Mesopotamia. A letter preserved in the Tell el Amarna collection, written by Assuruballit in about 1370 B. C. to the Pharaoh Amenophis IV, discusses the existing conditions of the road between Egypt and Assyria and complains that his mountain neighbor and commercial rival, the king of the Mittani, enjoyed special consideration in the Egyptian trade.[55] This letter indicates the ambition of the Assyrian king and the obstacles that lay in his path.

Assyria's Enemies

For the seven centuries of her westward advance, Assyria ran the gauntlet between enemies on the north and south who wished to get a foothold in the piedmont belt. From the south came repeated attacks from Babylon, several of which between 1300 and 960 B. C. succeeded in temporarily recovering Mesopotamia.[56] Moreover, the nomads of the grasslands were prone to encroach on the better-watered territory of the piedmont and constantly had to be expelled.[57] A decline of Assyrian power after the death of Tiglath-Pileser I enabled the Aramaean tribes of the Syrian Desert to push north and northeast into the Mesopotamian piedmont and the Naharina. They were drawn thither by the prospect of trade, for such nomads are natural middlemen. Hovering about the fringes of the cultivated land, they had probably furnished camel transport for the piedmont commerce or taken a hand in the caravan commerce down the Euphrates to Babylon. Now they established little independent states on the lower Khabur River, the Balikh, and on both banks of the Euphrates below Carchemish. Chief of these was Bit-Adini near Harran on the Balikh.[58] There they sought to maintain their independence against the attacks of Assyria, who tried to crush every rival middleman on the piedmont route. They were sustained by Babylon, who always hoped to reassert her claim to northern Mesopotamia; and they found a powerful champion and leader in Damascus, who, with the assistance of the nomads as well as the settled tribes, gravely threatened the western piedmont. When Assyria revived under Assurnazirpal (885-860 B. C.) it absorbed these little states, together with the Euphrates city Sura, river terminus of the desert route from Damascus via Tadmor.[59]

The piedmont belt was more seriously threatened from the north. It was repeatedly conquered in whole or in part by a succession of states which rose to power in the highlands of Armenia and the mountain ranges northwest of the great bend. These kingdoms, condemned by their rugged environment to backward economic development, based their meager

[55] Rogers, *op. cit.*, Vol. 2, pp. 7-8; Winckler: History of Babylonia and Assyria, p. 189.
[56] *Ibid.*, pp. 93, 101, and 103.
[57] *Ibid.*, p. 104; Strabo, Bk. 16, Ch. 1, §26.
[58] Rogers, *op. cit.*, Vol. 2, p. 28.
[59] *Ibid.*, Vol. 2, p. 57-62 and 74; Winckler: Geschichte Babyloniens und Assyriens, pp. 176-188.

national wealth on the raw products of forest, pasture, field, and mine. They wanted a frontage on the busy thoroughfare of the plain, in order to exchange their raw products for manufactured wares and share in the lucrative trade between East and West. This they achieved by conquering from time to time a section of the Mesopotamian piedmont, setting themselves up as middlemen and levying transit dues on the through traffic. Such were the Mittani, an Aryan people of the Armenian highlands, who about 1500 B. C. pushed their frontier southward over the rim of Mt. Masius and occupied the piedmont belt from Nineveh on the Tigris through Nisibis and Harran to the bend of the Euphrates.[60] Thus they got astride of the piedmont road and cut off Assyria and Babylon from the western trade.[61]

Assyria's Westward Expansion

In 1330 B. C. Assyria inaugurated her westward movement by expelling the Mittani from northern Mesopotamia. In 1270 B. C. Shalmaneser I consolidated the previous conquests, extended the frontier west to the Balikh River, if not to the Euphrates, and incorporated the city of Harran as his western capital on a par with Assur itself, to emphasize the union of the two states.[62] In order to secure the piedmont belt from attack, he conquered the Amida (modern Diarbekir) basin of the upper Tigris, advanced his frontier up to the main range of the Taurus on the north, which served as a border rampart, and planted Assyrian colonies through the newly acquired territories as outpost defenses of Mesopotamia.

This history repeated itself again in the reign of Tiglath-Pileser I (1170 B. C.), who pushed his way to the Mediterranean,[63] and with slight variations many times thereafter. Assyria during centuries of struggle for an open road to the western sea had constantly to beat back these mountaineers who threatened the right flank of her advance. Her main line of march was a corridor running along the base of their highland. Defeat involved withdrawal along this corridor, constantly exposed to flank attack. The semi-arid land south of the piedmont offered a difficult line of retreat in summer and a doubtful one in spring, when fodder indeed was abundant but when the widely flooded streams impeded the progress of an army. For military strategy this piedmont belt presented much the same problem as does the Venetian plain of northern Italy, between the Austrian Alps and the Adriatic, for an Italian army advancing from the Piave River to the Carso saddle. Therefore a mountain campaign in lower Armenia was the preliminary to every movement of Assyrian expansion along the piedmont belt.

This is the principle which emerges out of the fragmentary and confused

[60] Eduard Meyer, *op. cit.*, pp. 672-673.
[61] J. H. Breasted: History of the Ancient Egyptians, New York, 1916, p. 212.
[62] Winckler: Geschichte Babyloniens und Assyriens, pp. 154-161 and 165.
[63] *Ibid.*, pp. 172-175; Maspero: The Struggle of the Nations, pp. 643-647.

accounts of the wars from the fourteenth to the seventh century B. C. The highland campaign usually started from Nisibis, which controlled a road leading northward through an easy pass in Mt. Masius to the basin of the upper Tigris and thence west into the Hittite country of Asia Minor.[64] The offensive often had to be pushed as far west as the Melitene district of Cappadocia and the Commagene country, because these mountain states enclosed on the north the strategic district of converging highways west of the Euphrates bend. They commanded the passes and roads leading down to the plain of Naharina, which in turn commanded the Mediterranean outlets of the piedmont road. The temptation to encroach was irresistible, because a few months of sovereignty there yielded a big revenue in transit dues and commercial profits. Hence these little mountain states often risked the wrath of Nineveh. In the time of Tiglath-Pileser III (745-727 B. C.) they combined with the Armenian state of Urarta and extended their conquests to include Carchemish and Arpad, until the Assyrian forces drove them back again.[65]

Struggle of Egyptians and Hittites for the Syrian Saddle

Assyria's progress along the piedmont was a halting one, an alternating advance and retreat, owing to these constant flank attacks. Difficulties increased, however, as she approached the Syrian Saddle. The strategic importance of this district as focus of the converging western roads made it the object of attack from all sides. Here competitors multiplied—a recurring crop which had to be cut down. Prior to the Assyrian advance, while the Mittani were establishing themselves in the Mesopotamian piedmont, Thutmose I of Egypt (1530 B. C.) inaugurated a policy of territorial expansion northward to the Syrian Saddle, in order to eliminate the western middleman from the Babylonian trade, which had already assumed importance for Egypt. He and his successors secured their hold on the Naharina and the Euphrates bend, dominated the trading town of Carchemish at the middle passage of the river, and established peaceful relations with their Mittani neighbors, as the interests of trade demanded.[66]

The Egyptians held this strategic area 150 years, till 1375 B. C., when they were dislodged from it by the Hittites, who had gradually been advancing southward from their mountain seat in eastern Asia Minor. They combined with their kinsmen, the Khati, who occupied the rugged mountains between the upper Pyramus River and the Euphrates above the great bend, invaded the Syrian Saddle district, and got astride of the Euphrates bend east to the Khabur River at the cost of the Mittani.[67] From this base they pushed their conquests up the Orontes valley, which formed the

[64] Maspero: The Struggle of the Nations, pp. 364-365.
[65] Rogers, *op. cit.*, Vol. 2, pp. 114-118.
[66] Breasted, *op. cit.*, pp. 212-234.
[67] Maspero: The Struggle of the Nations, pp. 364-366.

southern approach of the Syrian Saddle. Thus they gathered into their hands the whole traffic between Babylonia on the east and Egypt and Phoenicia on the west. Hittite remains have been found all along the route of the Bagdad Railroad from the Amanus Range tunnel to the Khabur River, at Sendjerle, Aleppo, Jerablus (Carchemish), and Ras-el-Ain;[68] the ancient stations are the modern stations. Remains also at Alexandretta indicate that this excellent harbor was the Hittite sea terminus of the piedmont road, as it will soon be the Mediterranean terminus of the railroad.

The Hittites had to defend their position in the Syrian Saddle against repeated attacks by the Egyptians, who suffered by their exclusion from the piedmont trade and under Rameses II, from 1288 to 1271 B. C., made a last sustained but futile effort to regain their lost advantage.[69] Soon afterwards the Hittites were assailed on the east by the rising power of the Assyrians, who for centuries battled to get and maintain their hold on the Syrian Saddle. They found it necessary to expand over the Amanus Range into Cilicia,[70] in order to control the northwestern approaches through the Cilician Gates and other Taurus passes of Asia Minor. Assyria was forced also to dominate the Phoenician littoral, which made large contributions to the piedmont trade, in order to reap the full profits of her position.

The Phoenician Cities

The distribution of the ancient Phoenician cities in relation to the Mesopotamian piedmont reveals a significant interplay of geographic factors, of geographical isolation and security versus geographical proximity and accessibility to an established trade route, of a location which gave protection versus a location which gave profits. According to every law of geographical probability, the Phoenician settlements spread originally all along this coast from Mt. Carmel to the head of the Gulf of Issus. Mövers maintains such a distribution on the basis of place names, religious cults, mythology, and legend, even for cities like Tarsus and Mallus, which have been attributed to Greek colonists.[71] It is just around the Gulf of Issus, with easy access to the Syrian Saddle and fair harbors at Alexandretta and the mouths of the Cilician rivers, that we should have expected the Phoenicians to place their commercial ports. On the evidence adduced by Mövers, so they did.

The persistent aggressions of the Babylonians, Hittites, and Assyrians, however, from 3000 to 605 B. C., jeopardized especially the northern seaboard towns which lay near the Mediterranean outlet of the piedmont route. The Amanus and Bargytus (Ansariyeh) Mountains afforded no adequate bulwark to settlements along their coast against rear attacks. Relative

[68] D. G. Hogarth: Article "Hittites," Encyclopaedia Britannica, 11th edit., 1910.
[69] Breasted, *op. cit.*, pp. 280-285 and 428-430.
[70] Winckler: Geschichte Babyloniens und Assyriens, pp. 192-198, 223-226, 241-244, and 255-258.
[71] Mövers, *op. cit.*, Vol. 1, p. 404; Vol. 2, pp. 50-51 and 166-174.

security could be found only along the littoral of the broad and lofty Lebanon Range. There the great and enduring Phoenician cities grew up, protected by their geographical location—Tyre, Sidon, Berytus, Byblus, Bothrys, Tripolis, Arka, and Simyra near the northern end of the Lebanon Range. The location of all these cities was the resultant of two divergent geographic forces; it combined sufficient proximity to the piedmont road for participation in its trade, and sufficient remoteness combined with protected sites to insure the peace necessary for early industrial and commercial development. The sole exception to the rule is the conspicuous proof. That was the city of Arvad or Aradus, situated on a little island four miles off the Ansariyeh Mountains coast, about 30 miles north of Tripolis. When no war clouds hung on the land horizon, its citizens occupied a twin settlement on the coast called Antaradus and cultivated their terraced gardens while they gathered in Oriental merchandise from the inland trade routes; but, when the Assyrian wolf pack burst through the passes in the mountains, the people scurried into their boats and took refuge in their rocky island; there, Manhattanwise, they tucked themselves away in their ancient skyscrapers.[72] An Assyrian attack on the coast settlement of Aradus was the signal to the southern Phoenician cities to mobilize their forces for defense. Conquest was followed by a period of tribute paying, then by a period of successful revolt and independence, because the long reach from Nineveh to Tyre weakened the arm of Assyrian authority.

The Gulf of Issus, before the Greek period, was not permitted to breed on its shores the goose that might lay the golden egg of maritime commerce. Undoubtedly the goose was hatched again and again, built its nest, and then was destroyed. The easy seizure of the Phoenician city of Myriandros, located on the Amanus littoral near the foot of the Pylae Syriae (Beilan Pass, 2,395 feet), when Cyrus the Younger marched through in 401 B. C. for his invasion of Babylonia, shows how exposed was the location.[73] Alexander the Great planned Alexandretta on the basis of a unified political control from the Mediterranean to the Persian Gulf. We are forced to think with Mövers that very ancient Phoenician towns occupied the approximate locations of Antioch and Seleucia, which the Seleucids built as the Mediterranean outlet of the piedmont road. Situations so promising could not have been overlooked. They were apparent to Antigonus, who built the town of Antigonea five miles upstream from the later Antioch,[74] near the site of the old Phoenician Heraclea. Seleucia also occupied the exact site of an earlier settlement,[75] and it faced, across the little Bay of Antioch at the foot of Mt. Casius, the ancient port of Posidium, probably of Phoenician origin. On this marine inlet lay the city of Kundu in 670 B. C., an ally of

[72] Strabo, Bk. 16, Ch. 2, §§ 13 and 14.
[73] Xenophon: Anabasis, Bk. 1, Ch. 4.
[74] Diodorus Siculus, Bk. 20, Ch. 47; Strabo, Bk. 16, Ch. 2, § 4.
[75] Strabo, Bk. 16, Ch. 2, § 8.

Sidon and undoubtedly the seat of a Phoenician factory, which was seized by the Assyrians under Esarhaddon.[76] Thus these northern Phoenician settlements were destroyed or overlaid by Greek colonies, while the southern ones proved the law of the survival of the fittest, geographically speaking.

The Seleucid Kingdom

The Seleucid kingdom succeeded Alexander's rule in this transit region between the Mediterranean and the Persian Gulf, and it fattened on the trade which streamed along the piedmont road and out to the sea by Antioch and its port Seleucia. Like previous incumbents of the Syrian Saddle, it had to defend its strategic position against attacks from several sides; but it enjoyed this advantage, that Antioch and "the land of the rivers" formed the center and not the periphery of its domain, as was the case with the ancient Egyptian, Hittite, and Assyrian possessors of this focal district.

Egypt never through the ages lost her interest in the Syrian Saddle; nor has any modern dynasty or power, native or foreign, which has fallen heir to the throne of the Pharaohs. Control of the Suez or the Nile-Red Sea route to the Orient seems to have aroused a desire to control the Mediterranean outlet of the competing Mesopotamian route. The effort of the Eighteenth Dynasty to get astride of the Euphrates bend was repeated by Necho in 605 B. C., and this ambition colored the Asiatic policy of Egypt in the intervening centuries. It animated also the Ptolemies in their attacks upon the Seleucid power in Palestine, Syria, and Cilicia. Ptolemy II in 246 B. C. captured Antioch and Seleucia, Syria, Cilicia, "and the upper districts across the Euphrates."[77] He was unable long to hold all this territory but significantly enough he kept the seaport Seleucia in his grasp for twenty-five years.[78]

The Rise of Armenia

The declining power of the Ptolemies ceased to threaten the Seleucid state, which was also declining. At the beginning of the first century B. C. it had withdrawn to the west of the Euphrates before the advance of the reviving Persian or Parthian kingdom and soon was forced to defend its frontier along the Euphrates bend against a new enemy. The rising kingdom of Armenia, under its king Tigranes, had pushed its frontier south over the rim of its highland, and incorporated the Mesopotamian piedmont belt from Nineveh and Nisibis in the east to the old Carchemish district in the west.[79] It thus repeated the territorial expansion of the Mittani kingdom fourteen centuries before and with the same purpose—to get a frontage on the piedmont road. To emphasize the new outlook, the king built a

[76] Rogers, *op. cit.*, Vol. 2, pp. 223-225.
[77] J. P. Mahaffy: The Empire of the Ptolemies, London, 1895, pp. 34-35, 82, 87, 197, and 200.
[78] Polybius, Bk. 5, Chs. 59-60.
[79] W. R. Shepherd: Historical Atlas, New York, 1911, p. 33, map 2.

new capital, Tigranocerta, up in the foothills of Mt. Masius about 40 miles northwest of Nisibis; and he settled a tribe of Arab nomads in the Harran and Edessa (Urfa) districts, where they commanded the piedmont route and the chief fords or ferries of the Euphrates bend, so that they might collect transit dues for him.[80] To get outlets to the Mediterranean, he seized Antioch, northern Phoenicia, and eastern Cilicia but failed to hold them long. When Lucullus with his Roman legions pushed the Mithridatic war into Armenia in 69 B. C. and captured Tigranocerta and Nisibis, he found there treasure[81] which recalls the riches of the piedmont cities in ancient Assyrian days.

The Roman Advance

The Roman advance eastward, like the Assyrian advance westward, had to push its way between the enemy of the mountains and that of the plains, Armenians and Parthians, who came to make common cause against the Roman intruder. Every Roman offensive began with a campaign in highland Armenia, which automatically threw the piedmont belt into Roman hands. Highland Armenia, after its conquest, was allowed to fall away; but the piedmont was retained and therewith the great traffic route between East and West. The several Euphrates fords or ferries, Carrhae (Harran), Resaina, and Nisibis, became familiar with Roman merchants traveling to and from the East, Roman customs officials, and Roman armies bound towards the Tigris road on their way to Ctesiphon; for Parthian attacks were incessant. Nisibis was a Roman frontier fortress from 115 to 363 A. D. and the regular base of operations against the Parthian capital on the lower Tigris.[82] As the Empire declined, her eastern frontier fell back only a few miles behind Nisibis. The Patriarchate of Antioch reached from the Mediterranean to the Khabur River in 638 A. D. when the Saracens came.[83]

The Crusaders

After the Saracen conquest of Syria and Mesopotamia, traffic moved busily east and west along the piedmont road. The Arab geographers of the eleventh and twelfth centuries give glowing descriptions of its thriving cities with their irrigated fields, gardens, orchards, and vineyards, their crowded mosques and markets, as these existed under the Seljuk Turks in 1100 A. D.[84] Then the Crusaders came. With purpose more commercial than religious, they aimed directly for control of the Syrian Saddle. From 1098 to 1268 we find one noble house of Crusaders established in

[80] Theodor Mommsen: The History of Rome, New York, 1905, Vol. 4, pp. 315-317 and footnotes.
[81] *Ibid.*, Vol. 4, pp. 339-341.
[82] Mommsen: The Provinces of the Roman Empire, Vol. 2, pp. 72-73, 84-85, 94-95, and 98.
[83] Shepherd, *op. cit.*, p. 52, map.
[84] Le Strange, *op. cit.*, pp. 87-108.

the Principality of Antioch, extending from the Bay of Alexandretta and Laodicea east across the Orontes valley nearly to Aleppo (Fig. 4). This principality marched on the northeast with the County of Edessa (1098 to 1144), which stood fairly astride of the Euphrates bend, the upper Balikh and the upper Khabur, embracing the old district of Carchemish, Edessa, and the northern ford of the Euphrates at Samosata. The Crusaders' County of Tripoli included all the old Phoenician coast land from Aradus south to Berytus (Beirut).[83] There was keen competition among the Knights of the Cross for these profitable gateways to the East, but the throne of Jerusalem went begging.

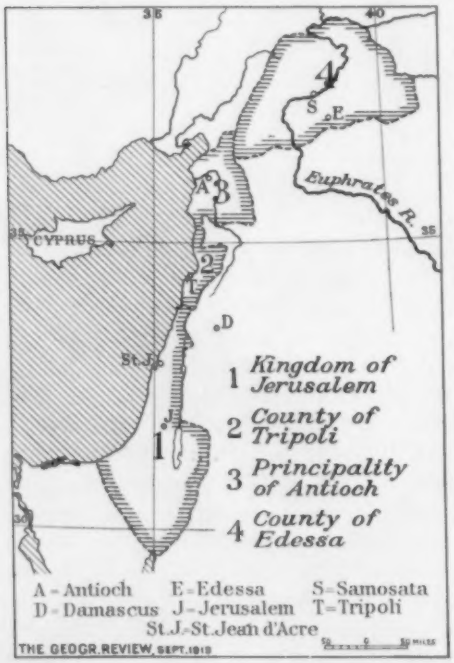

FIG. 4—(Slightly modified from Fig. 1, *Geogr. Rev.*, Vol. 1, 1916, p. 292).

EGYPT AGAIN

It was Egypt again, under the rule of the Mameluke Sultans, who next occupied the Syrian Saddle. By 1268 they held Antioch and Aleppo to the Euphrates bend, and gradually controlled the whole saddle. For over two hundred years it was theirs, while they advanced their frontier over Cilicia to the Taurus crest as a defensive boundary against the Ottoman Turks on the northwest. Very significantly, the Venetians, who since the Turks got astride of the Dardanelles (1356) were concentrating their trade at Alexandria and developing the Nile-Red Sea commerce with the Orient, in 1489 occupied Cyprus, apparently for nearer access to the competing piedmont route, whose outlets now were also in the hands of the friendly Egyptian government.

CYPRUS

It is a notable fact that all through history designs upon the Syrian Saddle, whether commercial or political or both, have been inaugurated or accompanied by the acquisition or occupation of Cyprus. Immediately after

[83] Shepherd, *op. cit.*, p. 68, map.

England in 1876 secured the controlling interest in Suez Canal stock through the agency of Disraeli, through the diplomacy of the same statesman she secured Cyprus (1878) and thereby control of the sea approaches to the possible Mediterranean termini of any future Bagdad railroad. The very outline of Cyprus suggests a hand pointing a pistol at the Bay of Alexandretta and the Orontes mouth.

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SCIENTIFIC RESULTS OF THE SECOND THULE EXPEDITION TO NORTHERN GREENLAND, 1916-1918*

I

MIGRATION ROUTES OF THE ESKIMOS IN NORTHERN GREENLAND

By KNUD RASMUSSEN

Eskimo House Ruins

The Second Thule Expedition had as one of its main objects the search for traces of earlier Eskimo migration. We found on our way from Etah to Humboldt Glacier an amazingly large number of ruins of earlier Eskimo buildings. Not less than nine settlements south and one north of Humboldt Glacier were determined, with a total of 60 houses. Wherever possible the ruins were measured. Regular excavation could not be undertaken on account of the extreme cold, as we passed the ruins at the beginning of April. Everything was covered with deep snow. Doubtless an examination undertaken in July or August would bring good results and give an opportunity to find more houses. I have been informed by Eskimo bear-hunters that settlements could be found far up Advance Bay, into which the expedition was not able to go, as it would have led too far away from the main route.

All measurements of house ruins proved them to have been extraordinarily small, evidently because of lack of building material. In order to build a real Eskimo house of stone, the material always used, one needs large, solid, and, if possible, flat stones. But as the rocks here consist of sandstone, only to be found in scattered pieces, it was impossible to build larger houses, even if the hunting conditions would have allowed such extravagance. This assumption is proved to be right by the fact that the houses near Rensselaer Bay and Marshall Bay were larger than all the others, because here were found gneiss and granite rock, while the hunting conditions were not better than where we found only small houses. In addition there were some peculiar fox traps, which were built in the manner of a cairn, sometimes 170 centimeters high, called *uvdlisatit;* these are no longer in use but are well known to the Eskimos. The name expresses the fact that one does not need to look after them every day.

The foxes were caught in the following manner: A decayed seal is placed at the bottom of a hollow stone cairn, while the entrance is covered

* The second of two articles presenting the results of the Second Thule Expedition, translated and ondensed from the report published in the *Geografisk Tidskrift*, Vol. 24, 1917-18, pp. 215-232. The first article, containing the narrative of the expedition by Knud Rasmussen, with map, appeared in the August *Review*.—EDIT. NOTE.

with willow twigs that are smeared with blood. The trap is built in a manner that makes it impossible for the fox to escape after he has jumped into it; and in this way several foxes can be caught in a few days.

The houses north of Humboldt Glacier were found in Benton Bay, about 12 kilometers distant from Cape Clay. In addition numerous tent rings and very large meat caches were discovered. The houses were built on gravel and small stones. The material was exclusively of stones, which were long and flat and sometimes rather large. In only one house we found that whalebones were also used. Several houses had remarkable forms; one of them was almost square, evidently on account of unfavorable material, poor rock, and lack of turf for pointing. The meat caches had the same forms and sizes as those we had measured and sketched on Blochs Island in Melville Bay.

The living conditions seem to have been splendid in this region. Many seals were observed, especially in the spring and the fall, and the ice around Humboldt Glacier gives good opportunity for bear-hunting. These house ruins in Benton Bay were the most northerly that were found by the expedition on the coast of Greenland. A thorough examination of the coast and the ice-covered land, with the assistance of our four Greenlanders, failed to produce any signs of an earlier building.

Improbability of Eskimo Migration Around Northern Greenland

Even in the large fiords, especially Sherard Osborn Fiord and Victoria Inlet, where we were convinced we should find house ruins, not one was discovered, in spite of the fact that our hunting trips, both going and coming, brought us to all accessible places in the region. It is my confirmed opinion, as a result of my experience on this expedition, that there has never been any migration of the Eskimos around the north of Greenland. My reasons for this are briefly:

(1) On the entire northern coast no tent rings, fire places, or other marks of Eskimos are to be found. All places that necessarily would have had to be used for hunting during a migration were thoroughly examined. The people on a migration with their women and children would not have gone deliberately into difficult regions. Pack ice from Polaris Promontory to Sherard Osborn Fiord would have offered a considerable obstacle to the transport of families and household furnishings.

(2) The Eskimo migrations were not due to nomadic instinct but mostly—when enemy neighbors were not the compelling reason—to the desire to reach more favorable hunting grounds. The peculiar ice and snow conditions on the northern coast of Greenland make hunting on the sea impossible, and the ice-free coast areas are not large enough to furnish sufficient game to stationary or wandering tribes.

(3) Besides this, the distances here are very great. From the tent rings near Hall's grave—the most northerly known tent rings on the western coast of Greenland (81⅔°)—to the tent rings near Independence Fiord—the most northerly known on the eastern coast—the distance which would have had to be covered by an Eskimo family is not less than 1,000 kilometers.

Taking up the last point in greater detail: From the houses in Benton Bay (80°), the most northerly known on the western coast of Greenland, to the houses near Mallemuk Rock on the eastern coast (80⅓°), the distance to be covered by sledge is not less than 1,500 kilometers, about the same as between Upernivik and Julianehaab. An Eskimo family, to cover this distance with its necessary paraphernalia and primitive hunting apparatus, would be forced to make stops at places where there were good hunting opportunities. The distances that are covered in a year, or, rather during the spring, are without doube very short. Besides, it is necessary for the wandering family to have the impression that the hunting conditions will improve from day to day.

Our expedition, which consisted of picked men equipped with the best weapons, had great difficulty in returning from these game-poor regions under the most favorable conditions of the season. I cannot believe that the climatological conditions and therewith the hunting conditions were different at the time the Eskimos undertook their migrations. The large fiords, St. George Fiord, Victoria Inlet, Sherard Osborn Fiord, Nordenskiöld Inlet, and all the other larger or smaller inlets as far as De Long Fiord, were filled with flowing inland ice, and nowhere on land were the conditions favorable for the existence of animals that would have permitted a family to stop for the winter.

The Eskimo members of our expedition were very unfavorably impressed by the bad conditions for seal-hunting and the poor material for building purposes, as the whole coast consists of loose shaly sandstones. They, like myself, were convinced that no Eskimo family would have dared to settle down on this coast.

In my estimation the natural conditions in the most northerly part of Greenland make an Eskimo migration from the western coast to the eastern coast by this route impossible. Granted that the climatological conditions and therewith the conditions for hunting were better at the time the Eskimos migrated—contrary to my belief—I do not think it possible that such migration could have left such slight traces as not to be discovered by the thorough examination of all the regions in every direction by our expedition.

Hitherto it has been believed that the Eskimos crossed over to Independence Fiord on the inland ice back of Peary Land proper. This would be impossible, as the existing conditions do not allow an ascent from the head of any of the fiords up to the inland ice. No Eskimo will undertake

a journey of 200 kilometers on the inland ice with wife and children, without knowing the natural conditions of the ground to be covered. A migration from northwestern to northeastern Greenland was impossible.

My belief is that several excursions were made to the north or east either from the winter houses near Lake Hazen on Grant Land or from Cape Benton; the tent rings near Polaris Promontory originate from such excursions. The unfavorable ice and hunting conditions were soon discovered, the route was given up, and the people went to Melville Bay, which is more thickly settled and has the most nearly ideal hunting conditions of all Greenland. From here they have scattered southward over all Greenland to Cape Farewell and from there followed the eastern coast. From the large settlement in the Angmagsalik district came the other Greenlanders all the way up to Mallemuk Rock, and from excursions and reconnoitering trips of these Greenlanders originate the tent rings found in Independence Fiord. At a later date I shall explain my opinions in detail and I will say only this in concluding my sketch:

One should be cautioned not to attach too much importance to the fact that musk oxen in small herds have migrated to the eastern coast around the north of Greenland. One is not warranted in deducing from this fact alone the conclusion that the Eskimos were able to procure food by which they could skirt northern Greenland and migrate down along the eastern coast.

II

BIOLOGICAL OBSERVATIONS: PRELIMINARY ACCOUNT OF DR. WULFF'S RESULTS

By C. H. OSTENFELD and MORTON P. PORSILD*

Dr. Thorild Wulff's diaries and the collections we brought home show how much science has lost through his death; up to his last breath he made observations and sketches of the plant and animal life.

The last record in his diary says what another cannot express; he wrote (in Swedish):

> Straining march until August 29 . . . . 12,30 A.M. without finding food. I am half dead, but found a little Woodsia fern. I lay down 7 P.M.; will not be a hindrance to my comrades' rescue. . . . .

Every page of his diaries proves the energetic spirit in which Wulff worked to procure valuable results for the expedition. Science owes this man much; and Sweden, his fatherland, and Denmark, to which he offered his last work, can be proud of what he did during a daily fight against death, that lasted almost three months.

* Dr. Porsild, Director of the Danish Arctic Station on the island of Disko, has looked over the diaries of Dr. Wulff and has written an account which I have used in connection with my own impressions, after looking through our collections, for a summary of the biological results.—C. H. O.

Dr. Wulff's Botanical Observations

The value of Wulff's collections can only be judged after closer examination; but, inasmuch as very little is known of the zoölogical and botanical life of these regions, these observations must be of great scientific interest. Already the preliminary examination of the dried flowering plants has established the existence of several interesting and geographically important species, as *Minuartia* (*Alsine*) *Rossii* and *Erigeron uniflorus*, which were found on the northern coast of Greenland.

It may be said that Wulff's botanical collections complete the floral examination of Greenland. Plant geographical variations will naturally be added in the future but will not increase the known flora of Greenland considerably, since almost the whole coast has now been visited by botanists. In regard to the lower-class plants and animals our knowledge is much less, and therefore Wulff's collections will produce new views, especially concerning geographical distribution. In addition to this, it must be mentioned that the geologist of the expedition, Lauge Koch, partly assisted by Peter Freuchen and the American explorer Ekblaw, made a quite complete collection of flowering plants from the environs of Thule (Wolstenholme Sound) in 1916 that will be valuable to plant geography.

At the beginning of June Wulff visited the coast of Markham Island (east of Elison Island, 83°), with its relatively rich vegetation, but had to return after some time for lack of game. Here at Markham Island, at the most northerly point he reached, which was near Low Point, he built a cairn in which he placed an account for the leader of the expedition, and on June 13 he planted the yellow-blue flag of his country on the top of the cairn, proud of the fact that he had brought it farther north than it had ever been brought before.

The biological results comprise: (1) Dr. Wulff's well-kept diaries and (2) the collections.

The Diaries

The diaries contain, besides an account of the route of the expedition, notes on weather conditions, photographs, etc., also physiologic-psychologic reflections on the deteriorating effect upon himself of fatigue and hunger.

Zoölogy

The zoölogical descriptions contain observations of the animals that were encountered by the expedition, especially of mammals and birds, and also fishes and animals of a lower order. Wulff was very desirous of finding out the conditions of life of the animals. He observed their methods of procuring food, the contents of their stomach, their propagation, and other biological matters, and tried to establish the temperature of the blood of some Polar animals.

Botany

Wulff's main botanical work was performed on the northern coast of Hall Land and farther north. He had to collect his material under quiescent winter conditions and was able only partly to identify the material on the spot. Therefore his diaries do not give an exact account of all he found. It seems that, in the very short time he worked, he had collected all higher-class plants that could be thought to exist there and several rare extreme arctic types, whose existence he established. Sixty-six species of higher-class plants are discussed in the diaries, and the working out of his collections will doubtless produce a greater number. Hitherto only 29 species were known from Humboldt Glacier northward. The diaries contain many observations on botanical conditions in extreme temperatures and on the biology of nutrition and reproduction.

Wulff made serial measurements of the temperature of and near the vegetating plants. It is of special interest that he was able to establish a total absence of higher plant life on the large 780 meter-high land inside of the inland ice belt which the expedition crossed on the return. Only a few species of moss and lichens were found; these did not grow on the calcareous ground but only on loose blocks of gneiss and diabase. Animal life even of a lower order could not be detected. So far no land in the northern hemisphere has been found to be so bare of life, and its like is only known on the Antarctic Continent. Wulff's observations will therefore be of the greatest interest in relation to the fate of the Greenland flora during the Ice Age.

After descending from the inland ice, Wulff found that the vegetation at the easterly end of Inglefield Land was far richer in species and in much better condition for examination. This part of Inglefield Land has hitherto been unknown botanically, while the more easily accessible western side has been well examined and shows a flora of 82 species.

The Collections

The collections comprise:

(a) A rich and beautifully prepared collection of flowering plants, mosses, and lichens, some species of algae and parasitic fungus and sponges.

(b) Several prepared birds, birds' eggs, some marine animals, many insects, and no small number of intestinal parasites of higher-class animals.

(c) Specimens of the soil and the contents of stomachs, taken for bacteriological examination.

(d) Specimens of sea water and plankton, collected to the depth of 400 meters on the voyage up from Disko to Thule in the fall of 1916. Examination of the water and the plankton will surely be of great interest, as the sea north of Disko has been little known from this standpoint.

III

Geographical Positions

By LAUGE KOCH

In regard to the cartographical results I refer to the geological map,[1] on which all geographical corrections and new discoveries are indicated. Only a few latitudes were calculated, and the larger part of the material has not yet been worked out. From the northern coast we obtained about 40 observations of latitude, about 80 determinations of azimuth, and about 40 determinations of longitude. The time was kept from Etah and return, during the whole voyage, without mishap. About 120 sketches and sights of land for cartographical and geological use were brought back. About 150 altitudes were determined trigonometrically.

IV

Summary of Geological Results[2]

By LAUGE KOCH

Stratigraphy

On the way up through Smith Sound and Robeson Channel one passes from south to north Archean, Algonkian, Cambrian, Silurian, and probably Devonian formations. A closer view shows that the strata extend across northern Greenland, forming belts in which one layer follows the other and the most recent are to be found farthest north. Archean formations are found in Melville Bay and toward the northeast. Algonkian strata are established in the region of Wolstenholme Sound-Inglefield Bay, south of St. George Fiord, and in the region Danmark Fiord-Independence Fiord. The strata consist of sandstone and limestone with ripple marks and diagonal structures. Some places show strong diabase eruptions. I found Cambrian slates near Cape Constitution (80½°). The fauna contains the same species as are found in northern Europe and New Brunswick. Silurian limestone exclusively from the lowest and middle Gotlandian is found in Washington Land, Hall Land, and towards Peary Land. Pentamerus lime and Rastrites slate (Clinton) underlie the limestone and Monograptus slate (Niagaran). The fauna resembles that of northern Europe, northern Asia, and northern North America. Green slates overlie the Silurian series. On the northern coast of Greenland these are folded into a mountain chain, which forms, with the Victoria and Albert Mountains of

[1] Its topographical outlines are reproduced on the map accompanying the first article, in the August number, p. 118.—Edit. Note.

[2] A translation of the geological results, as given *in extenso* in the Danish original, is to appear, it is understood, in the *Journal of Geology*.—Edit. Note.

Grinnell Land, a folded chain about 1,000 kilometers in length. The mountains are residual in character, and the folding that gave rise to later elevation probably originates from the second half of the Paleozoic Era. These layers prove a Paleozoic transgression, the largest known in Greenland. Its development is mainly the same as it is in Arctic North America.

Postglacial Formations

Up to the present no postglacial formations were found in Melville Bay. Postglacial formations in the Cape York district and on Washington Land are poorly developed. Deltas are found at the valley mouths; the highest of these reaches 160 meters. In many places old Eskimo houses fall into the sea, which may prove that the subsidence in Danish Greenland also takes place in the Cape York district. Alluvium is relatively widespread on the northern coast of Greenland. A lowering of 50 meters would submerge 2,000 square kilometers that are covered by marine layers. Marine formations with shells go up to a height of 135 meters. Strand lines are found up to a height of 210 meters. The northern coast was not more ice-covered when it was 100 meters lower than it is at present.

Glaciology

The belt of rocks and islands that gird the coast between Holms Island and Cape York are covered by low inland ice that leaves only the outer islands free. The inland ice in the Cape York district is apparently only in slow movement. Ice cracks are rare, a fact that is very important from the standpoint of communication between settlements. In a few places a strong advance movement has recently taken place in the glacier ice. The Humboldt Glacier can be considered as the edge of the inland ice, occupying a plain the edge of which is overflowed by the sea. Ice cracks are not to be found.

In Sherard Osborn Fiord, Victoria Inlet, Nordenskiöld Inlet, and in one arm of De Long Fiord flowing inland ice was observed. Southwest of St. George Fiord are large ice-free regions, while the regions toward Peary Land are thickly covered with ice. The northwesterly parts of Peary Land are ice-free, with the exception of a few local glaciers. These show signs of having had the same extent for a long period; there were found no proofs that they have either enlarged or decreased in size.

A NEW CLASSIFICATION OF CLIMATES

By ROBERT DeC. WARD
Harvard University

[With separate map, Pl. II, facing p. 188.]

It may truthfully be said that of the making of classifications of climate there is no end. An almost infinite number may be proposed, for the basis of subdivision may be the special conditions of any one climatic element; or similar combinations of two or more elements; or, again, the distinguishing characteristics may be found in botanical or in zoölogical relations. In a previous discussion by the present reviewer, the most important classifications of climates suggested before 1906 were considered.[1] A further paper dealt chiefly with the "thermal regions" suggested by the late Dr. A. J. Herbertson.[2]

Köppen's Classifications of 1900 and 1918

Among the numerous classifications of climate hitherto proposed, that of Dr. W. Köppen is especially noteworthy because of its emphasis upon certain critical and clearly defined underlying controls which serve as the basis of the subdivisions, because of the care with which these fundamental controls are worked out, and because of the simple way in which they are expressed.[3]

After an interval of nearly twenty years, Dr. Köppen now gives us a new, thoroughly revised classification,[4] which is clearly the result of further very searching analysis of all the most critical climatic controls, as well as of a study of other classifications which have been suggested during the intervening two decades, viz. those of De Martonne (1909), Penck (1910), Hettner (1911), and Drude (1913).

A comparison of Köppen's earlier map with the new one shows many resemblances, both in the larger climatic belts and in the smaller subdivisions. There are also certain broad resemblances in the general scheme of fundamental controls selected as the basis of the subdivisions. The new scheme is based upon temperature, rainfall, and seasonal characteristics. The critical features of the various combinations of these controls are

[1] R. DeC. Ward: The Classification of Climates, *Bull. Amer. Geogr. Soc.*, Vol. 38, 1906, pp. 465-477.

[2] *Idem:* A Note on the Classification of Climates, *ibid.*, Vol. 46, 1914, pp. 108-116.

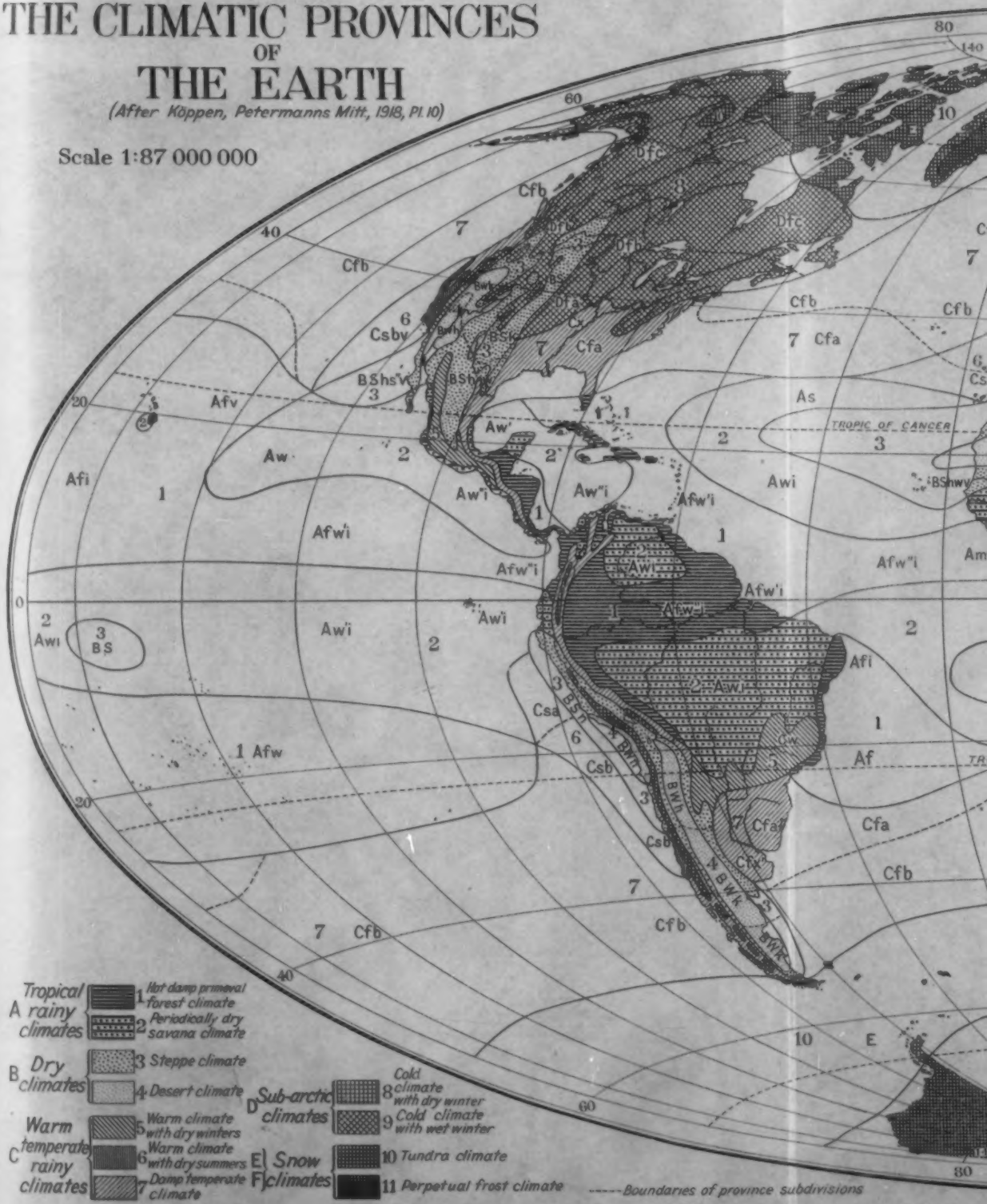
[3] W. Köppen: Versuch einer Klassifikation der Klimate, vorzugsweise nach ihren Beziehungen zur Pflanzenwelt, *Geogr. Zeitschr.*, Vol. 6, 1900, pp. 593-611, 657-679, with Pls. 6 and 7. The map has been reproduced in *Bull. Amer. Geogr. Soc.*, Vol. 38, 1906, opposite p. 468, and also in R. DeC. Ward's "Climate Considered Especially in Relation to Man," 2nd edit., 1918, p. 69.

[4] W. Köppen: Klassifikation der Klimate nach Temperatur, Niederschlag und Jahresverlauf, *Petermanns Mitt.*, Vol. 64, 1918, pp. 193-203 and 243-248, with map and diagrams.

THE CLIMATIC PROVINCES OF THE EARTH

(After Köppen, Petermanns Mitt, 1918, Pl. 10)

Scale 1:87 000 000



A Tropical rainy climates
1 Hot damp primeval forest climate
2 Periodically dry savana climate

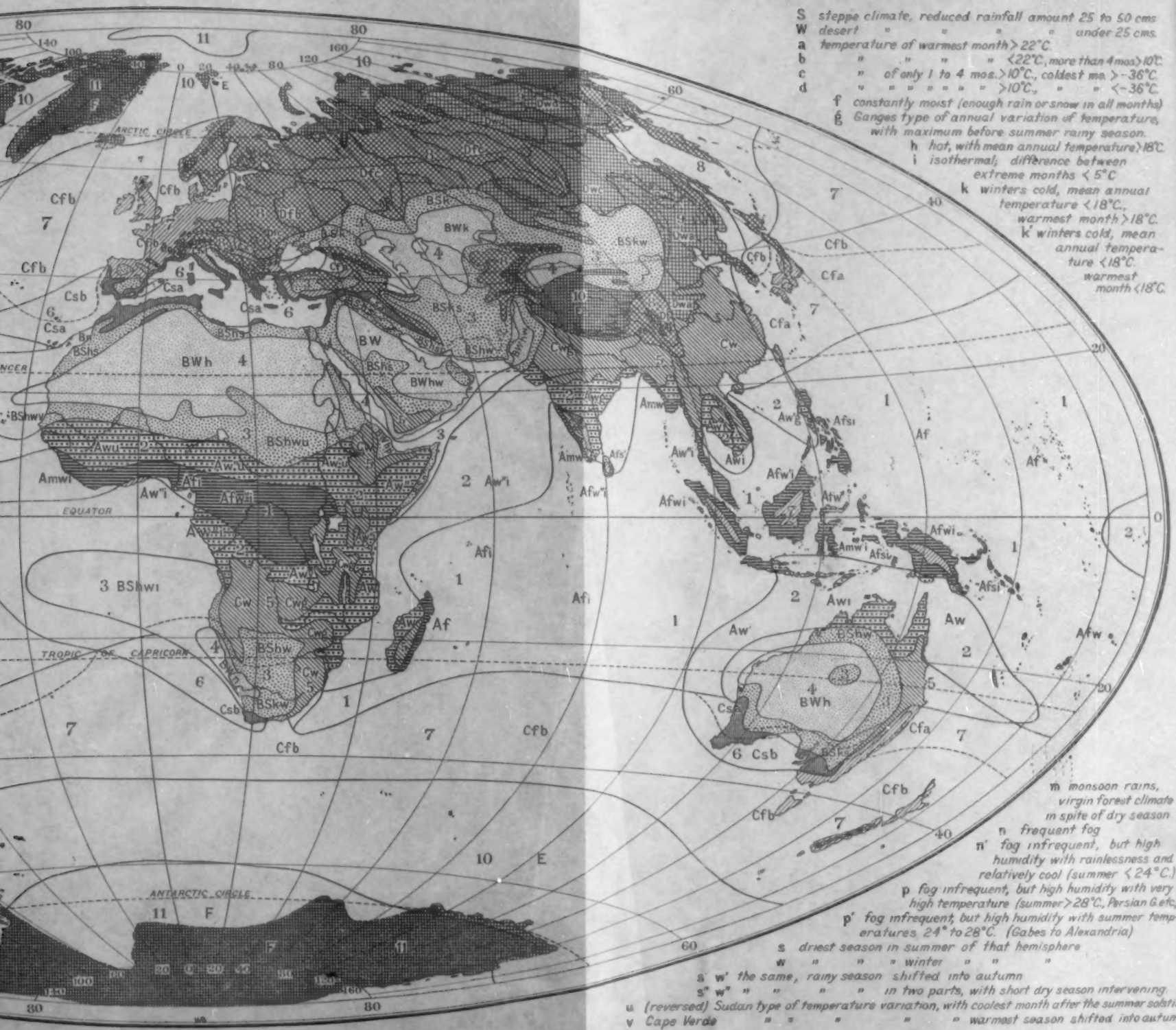
B Dry climates
3 Steppe climate
4 Desert climate

C Warm temperate rainy climates
5 Warm climate with dry winters
6 Warm climate with dry summers
7 Damp temperate climate

D Sub-arctic climates
8 Cold climate with dry winter
9 Cold climate with wet winter

E, F Snow climates
10 Tundra climate
11 Perpetual frost climate

-----Boundaries of province subdivisions



S steppe climate, reduced rainfall amount 25 to 50 cms
W desert " " " " under 25 cms.
a temperature of warmest month > 22°C.
b " " " " < 22°C., more than 4 mos. > 10°C.
c " of only 1 to 4 mos. > 10°C., coldest mo. > -36°C.
d " " " " " " > 10°C., " " < -36°C.
f constantly moist (enough rain or snow in all months)
g Ganges type of annual variation of temperature, with maximum before summer rainy season.
h hot, with mean annual temperature > 18°C.
i isothermal; difference between extreme months < 5°C
k winters cold, mean annual temperature < 18°C., warmest month > 18°C.
k' winters cold, mean annual temperature < 18°C. warmest month < 18°C.

m monsoon rains, virgin forest climate in spite of dry season
n frequent fog
n' fog infrequent, but high humidity with rainlessness and relatively cool (summer < 24°C.)
p fog infrequent, but high humidity with very high temperature (summer > 28°C., Persian G. etc.)
p' fog infrequent, but high humidity with summer temperatures 24° to 28°C. (Gabes to Alexandria)
s driest season in summer of that hemisphere
w " " " winter " " "
s' w' the same, rainy season shifted into autumn
s" w" " " " " in two parts, with short dry season intervening
u (reversed) Sudan type of temperature variation, with coolest month after the summer solstice
v Cape Verde " " " " " warmest season shifted into autumn

worked out with great accuracy and detail, and a brief, simple, and easily remembered scheme of letters and numbers—of "climatic formulae"—is used for the characterization of each climatic subdivision. One point in connection with this classification which deserves special mention is the fact that the oceans are included in it. This is one of the distinctive features of the new scheme, as it was of the original map of 1900, and adds greatly to its interest and value. The 1918 map is much more than the conventional "new edition" of the earlier one. It is not possible, in a brief note, to do justice to so elaborate a scheme as that which Köppen brings forward. A careful study of the original paper is essential if an adequate appreciation of the importance and the significance of the new classification is to be gained.

The Scheme of Classification of the 1918 Map

The fundamental zonal subdivision between equator and poles is in six broad belts, distinguished by capital letters, as follows: A, tropical rainy climates; B, dry; C, warm temperate, rainy; D, sub-arctic; E and F, snow. A is the megathermal zone, lacking a winter; C, the mesothermal, or warm temperate; and D the microthermal, with cold winters. Between A and C is the dry zone, B. The tundra belt is E, and the permanently frozen belt is F. These six larger zones are next subdivided into eleven provinces (1-11), beginning at the equator and clearly differentiated on the map by colors, red being used for the warmest, blue for the coldest, yellow for dry, etc.[5] The critical temperature, rainfall, and seasonal characteristics are worked out in detail, and a further scheme of small letters and of exponents is developed which makes possible the use of the series of simple and exact formulae, above referred to, which express the essential characteristics of each climate. Some of these designations are as follows: a = mean temperature of warmest month over 22° C.; h = mean annual temperature over 18° C.; n = frequent fog; n′ = fogs rare, but high relative humidity without rain and relatively cool (summers below 24° C.); s = driest season in summer; w = driest season in winter.

Examples of Climate Characterizations

As an illustration of the simplicity and the completeness of this method of designation we may take the province which includes most of the southeastern United States. This is No. 7 (damp temperate) and is shown in pink. Its formula is Cfa, i. e. (1) the warm temperate belt (C); (2)

[5] The meanings of the several numbers are as follows:

1. Hot, damp, primeval forest climate
2. Periodically dry savana climate
3. Steppe climate
4. Desert climate
5. Warm climate, with dry winters
6. Warm climate, with dry summers
7. Damp temperate climate
8. Cold climate, with dry winters
9. Cold climate, with wet winters
10. Tundra climate
11. Perpetual frost climate

always well watered, with sufficient rain and snow in all months (f); (3) mean temperature of warmest month over 22° C. (a).

Or, take Yuma. This is No. 4 (desert). Its formula is BWh. This means (1) the dry zone (B); (2) desert (W); (3) mean annual temperature over 18° C. (h).

The Present Reproduction of the 1918 Map

Plate II is a somewhat reduced reproduction, in black and white, of Köppen's colored chart. An attempt has been made to render the symbolism of the color scheme by means of rulings and stipplings. Hot and warm climates are shown in single rulings, semi-arid and arid in stipplings, and cool and cold in cross rulings, the depth of tone decreasing from both extremes of the scale toward the arid desert climate as a minimum. In a very few cases restricted areas of special climatic type, as in higher mountain regions, have been omitted.

Other Features of the Classification

Regarding the names of the various climates, Köppen suggests, as in his earlier scheme, the use of the general terms tropical rain forest, savana, steppe, etc.; of distinguishing forms of vegetation, e. g. oak, birch, etc.; and of descriptive terms such as damp temperate, etc. Again, following the plan of his earlier paper, Köppen shows the ideal geographical distribution of his climates diagrammatically, over a continent stretching from pole to pole. His diagrams include further a comparison of the temperature conditions in the two classifications, the annual migrations of the regions of high and low pressure and of aridity, and the pressure distribution in January and in July over both hemispheres.

Köppen's Comments on Climate and Civilization

The causal interrelations of the various climates are clearly set forth, and, in conclusion, there are some interesting comments on the climates of the geological past, on climate and soils, and on climate and civilization. Certain significant statements are made under the latter headings. For example:

> In the reconstruction of the climates of the past, the less such climates find support in present conditions, the greater caution should be exercised. Assumptions which rest upon a radical rearrangement of the general atmospheric circulation, and on the mean pressure distribution associated therewith, surely need to be supported by strong proofs.

And:

> The oldest civilizations developed in the climates of group B (arid) and on their margins: Egypt, Syria, Mesopotamia, portions of India and of northwestern China in the Old World, and in Mexico and Peru in the New World. . . . . The conditions for the development of these civilizations were found in irrigation, which makes possible a peaceable, well-regulated, and close association of many people, for it insures abundant crops as long as man submits to a well-organized common life and as long as he does not relax in his labor.

From early days, the centers of highest human development have gradually been displaced from the irrigated lands of lower latitudes to the cooler and rainier regions. Many dangers and difficulties are present in a modern highly developed state.

> The development which has led mankind from Babylon to London has in certain respects probably gone too far. On the one hand, it may be observed that too exclusive a concentration upon industry and trade in any country carries with it great dangers, and, on the other, with the aid of modern science and technical skill, we are again coming to practice agriculture under irrigation, instead of in conditions of uncertain natural rainfall. Thus the warm and sunny lands will regain some of the advantages which they have lost to the colder and damper climates, precisely in proportion to the degree with which man's scientific and technical skill succeeds in overcoming the difficulties of transportation and in mastering tropical diseases.

The foregoing comments will serve to indicate the underlying principles which have guided Dr. Köppen in the development of his new classification. No one who makes a close study of the author's discussion and of his map and diagrams can fail to realize how thorough, how systematic, and how *climatically sound* is the scheme. As a framework for studies of the climatic controls over the distribution of life it will prove of great value to students of botany and of zoölogy and to all who are concerned with the relations of man and his geographic environment. Those who are dealing with climates in any of their manifold aspects and relationships will find it a means of systematizing and of correlating their knowledge on a thoroughly scientific climatological basis.

GEOGRAPHICAL RECORD

NORTH AMERICA

Temperature Influence on Dates of Planting and of Harvesting in the United States. The detailed investigation of the influence of weather controls over agricultural operations in the United States is yielding valuable results of immediate practical economic importance to American farmers. A recent study, by Joseph B. Kincer, of the U. S. Weather Bureau, entitled "Temperature Influence on Planting and Harvest Dates" (*Monthly Weather Rev.*, Vol. 47, 1919, pp. 312-323), adds another interesting chapter to this subject.

There are naturally certain restricted time limits within which crops should be planted in order to secure the best results, these limits being defined by the temperature conditions of the locality. The length of the period within which the planting of a given crop may be accomplished decreases in general with increase in latitude. As a rough measure of the amount of heat required after planting to bring a crop to maturity, the accumulated day-degrees of temperature above the mean temperature at which planting is accomplished may be taken. It is suggested that the mean temperature at which the planting of a given crop can be accomplished be used as a base, or starting point, for any method that may be employed for temperature summation. Spring wheat seeding usually begins in the Dakotas and in Nebraska when the normal daily temperature rises to 37° F. and in Minnesota and Wisconsin when 40° is reached. The seeding of spring oats usually begins when the normal daily temperature rises to 43°, corresponding to the advent of the vegetative period. Early potato planting begins as a rule when the normal daily temperature rises to 45° and corn when 55° is reached. The dates on which the latter is reached correspond closely to the average dates of last killing frost in spring. Cotton planting usually does not begin until the normal daily temperature rises to about 62°. The dates on which this temperature is reached correspond closely to the latest dates in spring on which killing frost has occurred.

Cotton and corn are warm-weather crops, and the areas in which successful production on a commercial scale can be accomplished are limited principally by both the general temperature conditions and the temperature at which planting may be accomplished. Owing to the relatively large thermal requirements of corn and cotton, a comparatively warm spring is necessary for best results of germination and early growth.

Mr. Kincer's paper is illustrated by means of several charts showing the average dates on which the critical temperatures required for planting the various crops occur and by diagrams showing the accumulated temperatures for various sections and months.

In connection with this same subject, reference may here be made to a recent study by O. E. Baker, C. F. Brooks, and R. G. Hainsworth ("A Graphic Summary of Seasonal Work on Farm Crops," *U. S. Dept. of Agric. Yearbook for 1917*, pp. 537-589; abstracted in *Monthly Weather Rev.*, Vol. 47, 1919, pp. 323-327). Maps are given which show the dates when planting, harvesting, and other operations are performed in the culture of the staple crops in different parts of the United States. The seasonal distribution of labor by ten-day periods on typical farms in several important agricultural regions is shown by graphs. Information is also given as to the hours of labor per acre required in growing the staple crops in various sections of the country. R. DEC. WARD

Recent Explorations on the Isthmus of Panama. Though for four centuries the Isthmus of Panama has been the international crossing-place between two oceans, a large part of its territory is still almost unknown. In the March, 1919, number (pp. 309-321) of *Natural History* (formerly the *American Museum Journal*) there appears an account of recent explorations which were undertaken by an American army officer in the region between the city of Colón and the ancient harbor of Nombre de Dios and extending from the coast to the headwaters of the Chagres River system. This district, whose western end is almost within sight from the Canal Zone, is an uninhabited wilderness. Lieutenant Colonel Townsend Whelen, author of the article, says that throughout this district not a trace of human inhabitants was found. There are no roads, no trails, not even navigable streams. A luxuriant tropical forest covers the rough, hilly country. Through this, in some places, particularly on the border of the Canal Zone, where a dense second growth has occupied the land once cleared, passage had to be cut with machetes. Into such country it was found impracticable to lead the two companies of infantry that were

assigned to this task of exploration. Consequently, from a base-camp established near the eastern extremity of Gatun Lake, small parties consisting of four or five in a group went farther into the forests, remaining from a few days to a month's time according to the supply of food that could be carried or could be obtained in the regions explored. As the expedition was chiefly military and merely aimed at a preliminary exploration in preparation for a later thorough survey and mapping of the region, the scientific results obtained were necessarily meager.

Colonel Whelen, however, records some interesting observations regarding the country traversed. He discovered that the Río Grande, generally supposed to be one of the largest rivers along that section of the coast, is a short and very insignificant stream, while the Río Piedras, though it appears on few maps, is in reality one of the largest watercourses on the isthmus. He also believes that some of the mountains seen by him had never before been sighted.

This region, however, was better known in the early colonial days than at present. Roads existed across it in places, some mines were worked, and small settlements were made in what is now an uninhabited district. The old paved road leading from Panama to Nombre de Dios and Porto Bello, long the principal interoceanic route, led across near Mount Sáximo which Colonel Whelen saw. But with the passing of the Spanish galleons and the increasing use of the route around Cape Horn, these roads were abandoned, the settlements deserted, and the tropical forest regained supremacy. About the middle of last century, when surveys were being made for the Panama Railroad, engineers explored a part of this country, and their map (Map of the Isthmus of Panama representing the line of the Panama Rail Road as constructed under the direction of George M. Totten, Chief Engineer, etc., reduced and compiled from the original surveys by Thos. Harrison, Crown Surveyor, 1:96,000, Jamaica, 1857) is still probably the most detailed as well as the most accurate that has been published.

The Rainfall of Panama. H. G. Cornthwaite, Chief Hydrographer in the Panama Canal Zone, discusses the rainfall of Panama in a recent number of the *Monthly Weather Review* (Vol. 47, 1919, pp. 298-302). Most of the rainfall is of convectional origin, of the afternoon thundershower type. There is a dry season of about four months (January to April) and a rainy season of eight months. The rainfall is heaviest along the Atlantic coast and in sections of the upper Chagres drainage basin and diminishes gradually towards the Pacific coast. The heaviest annual rainfall at any station on the isthmus is approximately 170 inches, at Porto Bello, on the Atlantic coast. In the year 1909, 237.28 inches fell there, constituting a "record" for any station on the isthmus. A very favorable characteristic is the small annual variability of the rainfall, for this condition ensures a dependable water supply for the operation of the canal.

During the "dry season" the rains usually come in light local showers, but heavier general rains occasionally occur along the Atlantic coast in connection with "northers." The hour of heaviest rainfall is, as a rule, from 2 to 3 P. M. Along the Atlantic coast nearly half of the total rainfall comes at night, this being the result of a smaller percentage of afternoon thundershowers and a larger percentage of general nocturnal rains than occur elsewhere on the isthmus. In November and December general rainstorms, often accompanying storms of the "norther" type, may occur, occasionally lasting 24 hours or longer and some of them extending over the entire Canal Zone and adjacent territory. One of the largest freshets in the history of the Chagres River occurred on December 2-3, 1906, in a very heavy general rainstorm accompanying a severe "norther." The maximum 24-hour rainfall on the isthmus, so far recorded, is approximately 11 inches. This has been exceeded at several stations in the United States. R. DEC. WARD

EUROPE

Constantinople and the Straits. From the Trojan War to the Gallipoli campaign the straits connecting the Black Sea and the Mediterranean have possessed a unique strategic importance. According to the deductions of Leaf, Homeric Troy was in reality a great commercial center because of its command of the Black Sea route (W. R. Kermack: Notes on the Historical Geography of the Dardanelles, *Scottish Geogr. Mag.*, July, 1919). The narrow straits present difficulties to sailing vessels. A strong current sets from the Black Sea to the Mediterranean—a circumstance, it might incidentally be noted, that, through the agency of floating mines, proved a valuable help to Turkish defence in the late war. The channel is narrow and winding and during the winter is apt to be swept for days together by the dreaded Etesian wind. With tide and wind against them, sailing ships would be held up at the entrance to the straits, where furthermore Troy controlled the only sources of fresh water supply. The Trojan War is thus resolved into an early struggle for freedom of navigation.

With the fall of Troy trade between the Greek cities and the Black Sea entered on a prosperous epoch. The site of Troy, however, was not possessed of other advantages. The situation at the northern end of the straits is intrinsically far superior. Here is the great crossing point of the north-to-south seaway with the land road running from the Danube via the Maritza valley to Adrianople, crossing the Bosporus and proceeding by the Sakaria valley to the heart of Anatolia—the route of the Berlin-Bagdad railroad. Constantinople commands this crossing point. As soon as Trajan and his successors brought civilization to the Balkans and the Danube, Constantinople arose to capital importance.

Constantinople is exceptionally favored not only as regards situation but also as regards site. The "incomparable" natural port is as adequate to the enormous ships of today as to the modest vessels of Phoenicia and ancient Greece. From the entrance to the Bosporus the harmonious curve of the Golden Horn swings northwest for four miles, embracing a deep-water area with good anchorage (Paul Masson: Constantinople et les détroits, *Ann. de Géogr.*, March 15, 1919).

Under Byzantine rule Constantinople figured as the chief trading center of the world, a Paris and a London in one. Under Turkish rule, and especially in the last century, the city has declined in relative importance. Today the commercial movement of the port is exceeded even in the Mediterranean by Marseilles, Naples, Algiers, and Genoa. In part decline is due to miserable economic conditions in the Turkish Empire; among other things Constantinople is entirely lacking in modern port works and facilities. In part decline is due to a loss of the centralized control over roads and markets. The later eighteenth century saw the opening of freedom of navigation to the Black Sea. Constantinople also lost as a center of affairs. Improvement of communications in Anatolia, for instance, led to direct trade with local centers instead of through the great entrepôt.

Of the exact position of Constantinople as a port it is somewhat difficult to form an estimate; statistics are incomplete and otherwise inadequate. There has been a tendency toward gross exaggeration of the port movement through inclusion in statistics of ships passing in transit through the Bosporus. While the trade of Constantinople has relatively declined, that of the straits has been greatly augmented. In character this is distinctly different from that of the great port. Constantinople is a passenger port, a port for merchandise de luxe and the parcel post. The city, which lives in part on its momentum from the past, supports a large population—1,200,000—and perforce has a large import trade. Six-sevenths of the total trade is thus accounted for. Smyrna exceeds Constantinople in the value of exports. Freighters, especially, constitute the movement through the straits. A great proportion of the vessels are British, carrying coal outward and returning with grain from the Black Sea ports. At Constantinople, excluding the large coastal trade, France leads with a service of several regular liners.

Whatever the future, Constantinople must retain the nodal value of its situation, but there are indications of certain changes in the relative strengths of the converging movements. As an outlet for the Balkans it seems that the activity of the city must be more and more restrained. With railroad development there is also the rise of national ports. Kavala and Saloniki take their places besides Constantza, Burgas, and Varna. On the contrary there must be a gain on the Asiatic side as the agricultural and mineral wealth of Anatolia is made available. Constantinople will recover with interest the trade lost in the seventeenth century through the decline of the caravan routes. West and north are the great cereal lands of Bulgaria, Rumania, the Ukraine, of a productivity now comparatively low and now supporting a comparatively small population. Still more is the economic future before the lands farther east. The north-to-south commercial movement through the straits must be enormously increased, and it is especially on this movement that Constantinople must rely for the rebuilding of her ancient prosperity.

The Rainfall of the British Isles in 1918. According to a preliminary report on the rainfall of the British Isles in 1918 issued by the British Rainfall Organization (*London Times*, January 20, 1919, and *Symons's Meteorol. Mag.*, Jan., 1919, pp. 131-132) the past year was marked by an unusual amount of rain in each of the five major divisions of the islands. Wales showed an excess of 13 per cent above the average, Ireland 11 per cent, North England 10 per cent, Scotland 6 per cent, and South England 5 per cent. The excess for the United Kingdom as a whole was 9 per cent. This is a decided contrast to the rainfall of the preceding year, which showed 3 per cent less than the average. In fact, Dr. H. R. Mill, the director of the organization, had already called attention to the series of alternating fat and lean years that has been running since 1910 and had forecast as probable a heavier precipitation for 1918.

If the islands are divided into regions on the basis of their average precipitation, instead of along political boundaries or according to latitude, we find that the usually dry region of eastern Scotland and east-central England enjoyed no greater moisture,

but rather suffered, during 1918, a decided deficiency, amounting in some cases to 18 per cent. On the other hand, the great excess of the year was in the wet regions of the west, where it reached as much as 20 and even 30 per cent along the coast of Wales, Ireland, and Scotland. Thus the wet districts were wetter and the dry districts drier than in normal years.

Comparing the data and maps for 1917 with those of last year (see Hugh Robert Mill and Carle Salter: On the Distribution of Rain in Space and Time over the British Isles During the Year 1917, London, 1918; reviewed in *Geogr. Rev.*, Vol. 7, 1919, pp. 354-355) we find that, in general, the same condition held true, viz. the drier sections showed a deficiency and the wetter sections an excess, though over the islands as a whole the year ranked as a dry one, there being only 97 per cent of the usual rainfall. This would seem to indicate an intensifying of the control or controls responsible for the regional difference in precipitation, or, perhaps, a diminution of the forces which tend to interfere with those controls. Though no record of wind directions for the year is as yet available, the distribution above noted would appear to indicate an unusual prevalence or effectiveness of the rain-bearing southwesterlies. These rains water the western shores and the highlands but bring little precipitation to the eastern sections. The latter, depending for their rain upon easterly and northeasterly winds during the interruption of the southwesterlies, fare badly when this interruption does not take place.

A notable feature of the year's rainfall was the unusually wet September, when over most of the United Kingdom there was an excess of more than 100 per cent. This was especially marked in the southern part of England. At London it was the wettest September in the long record of 61 years, 25 days during the month being marked as rainy. This month does not stand alone, however, for during the year seven months show more rainy days than the average year and six months had heavier rainfall than is usual. There was a total of 195 rainy days in London, the average being 163.

PHYSICAL GEOGRAPHY

Does the Moon Cause a Tide in the Air? Dr. S. Chapman has supplemented the earlier work of Laplace and Airy on the lunar atmospheric tide by analyzing the observations made at Batavia and Hongkong together with the records of Greenwich in order to determine the influence of latitude (S. Chapman: The Lunar Atmospheric Tide at Greenwich, 1854-1917, *Quart. Journ. Royal Meteorol. Soc.*, Oct., 1918; idem: The Lunar Tide in the Atmosphere, *Nature*, May 8, 1919). These observations were derived from the registers of a barometer whose readings are taken to 0.001 inch of barometric pressure; and the scale of the photographic register multiplies this by four. The analysis was facilitated by the use of "quiet" days so as to eliminate, as far as possible, the irregular pressure changes, due to various causes, that are characteristic of the atmosphere especially in high latitudes. The extent of the computation was very great, but the results fully justify the necessary expenditure of time and funds.

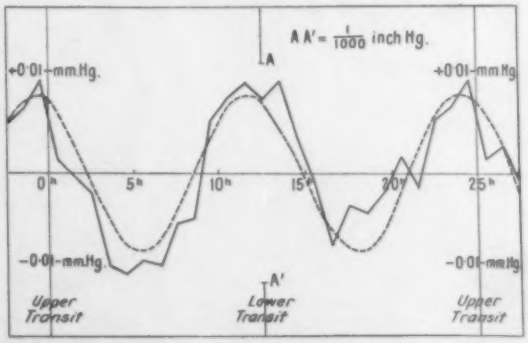


FIG. 1—The lunar semi-diurnal tide in the atmosphere at Greenwich, as determined from the Greenwich records of barometric pressure, 1854-1917. (Copied from a figure in the articles cited in the text.)

The inner two vertical lines mark out a complete lunar day, on either side of which a small portion of the curve is repeated.

The work demonstrated a lunar tide appreciably less than one-thousandth of an inch (AA' in Fig. 1). The unbroken line of the figure shows the mean lunar hourly inequality of pressure; the broken line is its semidiurnal component. "The accordance between the two graphs shows in a striking manner how effectively this extremely small lunar tidal variation in the atmosphere has been disentangled from the solar and irregular fluctuations of barometric pressure."

GEOGRAPHICAL NEWS

French Geographical Appointments in Alsace-Lorraine. In connection with the reorganization of the administration of Alsace-Lorraine incident on the reversion of the two "lost provinces" to France, several scientific appointments of geographical interest are announced. M. Emmanuel de Margerie, the well-known geographer and geologist, has been appointed Director of the Geological Survey of Alsace-Lorraine. Geography will be represented by two chairs at the University of Strasbourg, one occupied by Professor Henri Baulig, recently of the University of Rennes, the other by Pierre Denis, the well-known specialist on South American geography.

PERSONAL

MR. VERNON BAILEY of the U. S. Biological Survey addressed the Biological Society of Washington on May 3 on "The Explorations of Maximilian, Prince of Wied, on the Upper Missouri in 1833." Dr. Bailey described the travels of this early naturalist and discussed his zoögeographical observations.

PROFESSOR HOWARD E. SIMPSON, associate professor of geology and physiography at the University of North Dakota, has been promoted to a professorship of geographic geology at the same institution. Professor Simpson was a member of the American Geographical Society's Transcontinental Excursion of 1912.

PROFESSOR J. RUSSELL SMITH, lately of the University of Pennsylvania, has been appointed Professor of Economic Geography at Columbia University. Professor Smith will give courses in the College, the School of Business, and the Graduate School. His courses will deal with general economic geography, the economic geography of Europe, Latin America, Asia, and Africa and Australia, and with the influence of geographical environment on human affairs.

DR. T. WAYLAND VAUGHAN of the U. S. Geological Survey returned to Washington in the late summer after spending several months in a geologic reconnaissance of the Dominican Republic for the Dominican Government. Dr. Vaughan also visited Port-au-Prince, Haiti, and made arrangements with the Haitian Government for a preliminary geological survey of Haiti.

GEOGRAPHICAL PUBLICATIONS

(Reviews and Titles of Books, Papers, and Maps)

For key to classification see "Explanatory Note" in Vol. II, pp. 77-81

NORTH AMERICA

UNITED STATES

South Atlantic States

CLARK, W. B. **The geography of Maryland.** Maps, diagrs., ills. *Maryland Geol. Survey* [*Gen. Repts.*], Vol. 10, 1918, pp. 41-167. Johns Hopkins Press, Baltimore, 1918.

After an introduction (25 pp.) this work treats in order the geology of the state (5 pp.), the physiography (29 pp.), the climate (3 pp.), the flora and fauna (1 p.), the natural resources (35 pp.), the manufactures (3½ pp.), and the cities and towns (6 pp.). Following these topics are suggestions for physiographic and geologic excursions (10 pp.) and tables of statistics (10 pp.).

The comments of two reviewers are given below.

Dr. Clark's appreciative attitude in this report is shown by the following statement, with which his treatment of the various physiographic provinces is entirely consistent: "The physical features of a country in no inconsiderable degree determine the pursuits of its inhabitants, and these indirectly affect their social, political, and financial welfare. It becomes necessary, therefore, to know something of the physical features of a state if one would understand its past history or indicate the lines of its future prosperity."

The introduction covers about a fifth of the text and includes a wide variety of topics, some of them, such as education, revenue, and taxation, being only remotely geographic in character. Formal geology is very briefly treated and includes little more than a table of the formations which occur in Maryland. However, there is considerable geological description in the treatment of physiographic features. Much emphasis is rightly placed on the physiographic provinces, which are so well represented in Maryland. Each description of a province includes not only the physiography and its origin but also a discussion of the human relations.

To the eastward lies the Coastal Plain province, which includes the low, flat areas of the "Eastern Shore" and the rolling areas of the "Western Shore." The sinking of the coast has produced Chesapeake Bay, with its drowned estuaries which permit boats to penetrate far into the interior and promote both interstate and intrastate commerce. The shallow waters of the bay and its tributaries also furnish the oysters which make the state famous. The Piedmont Plateau to the westward is divided into the eastward and the westward portions by Parr's Ridge, a divide between the drainage of the Chesapeake and the Potomac. The productive soils were early utilized for farms, and the roads led across the uplands rather than along the valleys. The Blue Ridge, Greater Appalachian Valley, Alleghany Ridges and Valleys, and the Alleghany Plateau are briefly described. A very useful topic is the suggestions for physiographic and geologic excursions in different parts of the state.

The style is simple and readable, and the report is entirely free from the "boosting" features which are far from uncommon in many similar state reports. Excellent maps and sections are liberally used, and the illustrations really illustrate the text. The discussion of peneplanation in the Piedmont and Appalachian regions is not likely to be clear to the lay reader. Dr. Clark wrote with such fullness of knowledge that he probably overestimated his readers' ability to follow him. In the reviewer's judgment, the treatment of climate is too brief; for surely climate is one of the great geographic factors affecting mankind. The report is welcome as showing the appreciation of geography by a leading earth scientist; it should also encourage other state surveys and organizations to put sane, readable geographic information before their readers.

F. V. EMERSON

This is a posthumous work of Dr. William Bullock Clark, who for years previous to his death in July, 1917, had been professor of geology in Johns Hopkins University,

state geologist, director of the Maryland Weather Service, state forestry commissioner, state roads commissioner, etc., and had therefore had exceptional opportunities for knowing his adopted state thoroughly. Much if not most of the material in the book, including illustrations, had appeared previously in other works by the author and various associates, particularly a pamphlet on the natural resources of Maryland prepared for the Chicago World's Fair, a report on the physical features of the state which occupied a large part of the first volume of *Maryland Geological Survey General Reports* (1897) and was revised and elaborated in the sixth volume of the same series (1907), a report on the physiography of Maryland by Cleveland Abbe, Jr., in the first volume of the Maryland Weather Service reports (1899), the "Plant Life of Maryland" by Forrest Shreve and others, which constituted the third volume of the series last named (1910), and several voluminous county monographs of the Maryland Geological Survey. Typographically it is of the same high class as other official scientific publications of Maryland.

The topic of flora is very briefly treated, probably because regarded as having been sufficiently covered by the "Plant Life of Maryland"; but there seems to be no satisfactory treatment of the fauna of the state in any official publication, and it is indeed a rather difficult matter for a geographer to handle.

Regional geography is treated under physiography. The state is divided into three main divisions, coastal plain, Piedmont, and Appalachian, each with two or three subdivisions. The regional treatment of the coastal plain seems very inadequate to one familiar with the great diversity of that province. It is divided in this work, as in a few previous publications of the Maryland Geological Survey, into a few supposed Pleistocene terraces (first distinguished by G. B. Shattuck in 1901), which are hard for the uninitiated (including the reviewer, who has been in every county in Maryland and specialized on the coastal plain) to recognize and are chiefly of academic interest anyway, for they are not shown in this work or elsewhere to bear any constant relation to soils, vegetation, population, or agriculture. In reality the features just named correlate much better with a map of the Cretaceous and Tertiary formations, which is very different from a terrace map, and it is strange that this relation has not been more clearly perceived by geologists. Even the striking differences in shore lines made by the different geological formations on the Bay side of the Eastern Shore, which are very obvious on a good geological map, receive no mention.

The several regions are not contrasted statistically, even in such simple matters as density and color of population, but this may be partly because the counties are so large that most of them cover parts of two or more regions. The book contains no maps other than small text figures occupying about a third of a page each; but a large colored geological map of the state published in 1906-07 (one edition of which shows the supposed terraces of the coastal plain) is distributed separately by the Survey and should be used in connection with this work.

In the chapter on agriculture are seven maps showing the value of farm buildings and production of certain crops per county (which means little, for the counties of course are not all the same size), by means of shading in several—usually seven—grades. The period to which these statistics pertain is not indicated, but it is presumably that of the Twelfth Census (1899-1900), for the same maps appeared in F. H. Blodgett's chapter on agriculture in the "Plant Life of Maryland" in 1910. They are very poorly visualized, for while the lowest grade is left blank in every case, the two next lowest, on every map but one, have the densest ruling.

This handsome state geography will doubtless be appreciated by Maryland teachers and, together with its predecessors, will furnish an excellent foundation for future systematic work on the geography of this very accessible and diversified state.

ROLAND M. HARPER

BOWMAN, H. H. M. **Botanical ecology of the Dry Tortugas.** Diagrs., ills. *Papers from the Dept. of Marine Biology of the Carnegie Inst.*, Vol. 12, pp. 111-138. Washington, D. C., 1918.

CARY, L. R. **The Gorgonaceæ as a factor in the formation of coral reefs.** Map, ills. *Papers from the Dept. of Marine Biology of the Carnegie Inst.*, Vol. 9, pp. 343-362. Washington, D. C., 1918. [Deals with the Florida-Antillean region.]

DOLE, R. B., AND A. A. CHAMBERS. **Salinity of ocean-water at Fowey Rocks, Florida.** Diagrs. *Papers from the Dept. of Marine Biology of the Carnegie Inst.*, Vol. 9, pp. 299-315. Washington, D. C., 1918.

HARPER, R. M. **A phytogeographical sketch of southern Maryland.** *Journ. Washington [D. C.] Acad. of Sci.*, Vol. 8, 1918, No. 18, pp. 581-589.

HARPER, R. M. **High living standards in "black" counties (in the southeastern United States).** 2 pp. University, [Ala.,] 1919. ["Slightly abridged from a letter published in *The Montgomery Advertiser* . . . . March 28, 1919."]

HEYE, G. G., F. W. HODGE, AND G. H. PEPPER. **The Nacoochee mound in Georgia.** 103 pp.; diagrs., ills. *Contribs. Museum of the Amer. Indian, Heye Foundation*, Vol. 4, 1918, No. 3. New York.

HULL, J. P. D., LAURENCE LA FORGE, AND W. R. CRANE. **Report on the manganese deposits of Georgia. (Second report on manganese).** Foreward by S. W. McCallie. xiv and 295 pp.; maps, diagrs., ills., index. *Geol. Survey of Georgia Bull. No. 35.* Atlanta, 1919.

SCHWAB, W. G. **The forests of Dickenson County, Virginia.** 17 pp.; map, ills. *Virginia Geol. Commission Bull. No. 17.* Charlottesville, 1917.

SCHWAB, W. G. **The forests of Tazewell County, Virginia.** 14 pp.; map, ills. *Virginia Geol. Commission Bull. No. 18.* Charlottesville, 1917.

SELLARDS, E. H. **Florida State Geological Survey: Tenth and eleventh annual reports.** 130 pp.; maps, ills., index. Tallahassee, 1918.

SHEARER, H. K. **Report on the slate deposits of Georgia.** x and 192 pp.; maps, diagrs., ills., index. *Geol. Survey of Georgia Bull. No. 34.* Atlanta, Ga., 1918.

SWICK, C. H. **Triangulation in Georgia.** 59 pp.; maps, index. *U. S. Coast and Geodetic Survey Serial No. 65.* Washington, D. C., 1917.

VAUGHAN, T. W. **The temperature of the Florida coral-reef tract.** Maps. *Papers from the Dept. of Marine Biology of the Carnegie Inst.*, Vol. 9, pp. 321-339. Washington, D. C., 1918.

WATSON, T. L. **The Virginia earthquake of April 9, 1918.** Map. *Bull. Seismol. Soc. of Amer.*, Vol. 8, 1918, No. 4, pp. 105-116. Stanford University, Cal. [Evidence available from reports, seismograph records, and a consideration of the geological structure of the district affected indicates that this earth tremor had its origin in one or more of the faults known to exist in the parallel ridges that bound the Shenandoah Valley.]

[*Topographic map of the United States.*] Sheets, 1:62,500: (1) ***Cape Henlopen,*** (2) ***Cedar Creek,*** (3) ***Rehoboth, Del.;*** (4) ***Harrington, Del.-Md.;*** (5) ***Cambon,*** (6) ***Jacksonville,*** (7) ***Mayport,*** (8) ***Middleburg,*** (9) ***Orange Park,*** (10) ***Palm Valley, Fla.;*** (11) ***Cumberland,*** (12) ***Everett City,*** (13) ***Hinesville,*** (14) ***Hortense,*** (15) ***Jesup,*** (16) ***Nahunta, Ga.;*** (17) ***Folkston,*** (18) ***Kingsland,*** (19) ***Moniac, Ga.-Fla.;*** (20) ***Walterboro, S. C.;*** (21) ***Aylett,*** (22) ***Carterton,*** (23) ***Charles City,*** (24) ***Doswell,*** (25) ***Morattico, Va.;*** (26) ***Richmond, W. Va.*** U. S. Geol. Survey, Washington, D. C., 1918.

Western States

—— **Anza, Colonel Juan Bautista de, Governor of New Mexico: Diary of his expedition to the Moquis in 1780.** With an introduction and notes by Ralph E. Twitchell. 47 pp.; ills. *Hist. Soc. of New Mexico* [*Publ.*] *No. 21.* Santa Fe(?) [Paper read at the annual meeting, 1918.]

ATWOOD, W. W. **Relation of landslides and glacial deposits to reservoir sites in the San Juan Mountains, Colorado.** 38 pp.; maps, diagrs., ills. *U. S. Geol. Survey Bull. 685.* Washington, D. C., 1918.

DANA, S. T. **What the National Forests mean to the water user.** 52 pp.; map, ills. U. S. Dept. of Agriculture, Forest Service, Washington, D. C., 1919. [A popular discussion of the value of national forests.]

GRAVES, H. S. **Thunder Mountain.** Ills. *Amer. Forestry*, No. 303, Vol. 25, 1919, March, pp. 907-911. Washington, D. C. [This important watershed in central Idaho, from which many streams flow into the upper tributaries of the Columbia River, has not yet been included within the National Forests by which it is surrounded. The Chief Forester urges the necessity of its being so included, both as a safeguard against the spread of fire into the adjoining timber and as a protection to the water supply of the Columbia.]

HALLENBECK, CLEVE. **Night-temperature studies in the Roswell fruit district.** Map, diagrs. *Monthly Weather Rev.*, Vol. 46, 1918, No. 8, pp. 364-373. Washington, D. C. [This district, covering an area of 1,200 square miles, mostly west of the Pecos

River, New Mexico, includes practically all of the fruit-growing and farming lands of the valley.]

KNOPF, ADOLPH. **A geologic reconnaissance of the Inyo Range and the eastern slope of the southern Sierra Nevada, California.** With a section on the stratigraphy of the Inyo Range, by Edwin Kirk. 130 pp.; maps, diagrs., ills., bibliogr., index. *U. S. Geol. Survey Professional Paper 110.* Washington, D. C., 1918. [This paper describes the region containing the recently developed wolfram deposits of the Tungsten Hills.]

VARNEY, B. M. **Thirty-year synopsis: Meteorological observations made at Berkeley from July 1, 1887, to June 30, 1917.** Diagrs. *Univ. of California Publs. in Geogr.*, Vol. 2, 1919, No. 1, pp. 1-18. Berkeley.

MEXICO AND CENTRAL AMERICA

PANI, A. J. **Hygiene in Mexico [City]: A study of sanitary and educational problems.** Transl. by E. L. de Gogorza. xii and 206 pp.; diagrs. G. P. Putnam's Sons, New York and London, 1917. $1.50. 7½ x 5.

Mexico City is the most unhealthful large city in the world, in spite of the fact that its situation at an elevation of 7,000 feet gives it advantages over other tropical cities situated near sea level. The author of this work points out some of the causes of the high death rate. Modern man is not entirely responsible. A large share of the guilt rests upon Cortés, who, contrary to explicit instructions from the Spanish crown as to the sanitary conditions necessary for the site of New Spain's capital, determined to build upon the ruins of Tenochtitlan. In the opinion of Señor Pani a worse location could scarcely have been found. Situation, topography, the character of the soil, temperature, humidity of the atmosphere, rains, and winds, all contribute toward its unhealthfulness. The depression occupied by Lake Texcoco, around which the city is built, was the lowest part of the enclosed upland basin and hence received and retained the entire drainage of the city and the surrounding region. This condition was partly remedied by the completion in 1900 of the famous *desague*, or drainage canal, one of the greatest engineering enterprises ever undertaken. As the city grew out over the swampy borders of the lake, a water-soaked subsoil kept the surface far too damp for healthful conditions. Moreover, great daily range of temperature, marked difference between the shade and the sun, and sudden abrupt changes combine with high atmospheric humidity during the summer months to make distempers of the digestive system very common. Added to this, the prevailing northerly winds come from valleys destitute of vegetation and bring clouds of dust. Diseases of the respiratory organs cause an average of 4,329 deaths a year in this city of 471,000 people.

According to the author the case is grievously aggravated by the entire lack of sanitary precautions among all classes of the people, who have not yet taken to heart the new doctrine that "filth is a sin." The dwellings lack sanitary provisions. Halls, vestibules, etc., which would serve to avoid sudden changes of temperature in passing from room to room are uncommon in the Mexican style of building about an open *patio*. Window space, too, is sadly lacking. The streets, laid out in north-south and east-west directions, afford poor distribution of sunlight, while they are almost invariably so narrow as greatly to limit the hours of exposure to the sun's rays.

Though many of these natural disadvantages cannot be remedied, the author urges the organization of a far more effective sanitary service. He believes, too, that general education of the people and better economic conditions for the poorer classes will make possible a greater degree of hygiene that will offset some of the defects in location and construction of the city.

BUSTAMANTE, MIGUEL. **El petróleo en la República Mexicana: Estudio geológico económico sobre los yacimientos petrolíferos Mexicanos.** Part I. iv and 216 pp.; maps, diagrs., ills. *Inst. Geol. de Mexico Bol. No. 35.* Mexico, 1918.

LÓPEZ, ELPIDIO. **Régimen pluviométrico de la República Mexicana.** *Bol. Soc. Mexicana de Geogr. y Estadística*, Vol. 7, 1918, No. 8, pp. 425-429. Mexico.

LÓPEZ-PORTILLO Y ROJAS, JOSÉ. **Los Chimalhuacanos.** Ills. *Bol. Soc. Mexicana de Geogr. y Estadística*, Vol. 8, 1918, No. 1, pp. 42-67. Mexico.

POWERS, SIDNEY. **Notes on the geology of eastern Guatemala and northwestern Spanish Honduras.** Maps. *Journ. of Geol.*, Vol. 26, 1918, No. 6, pp. 507-523.

ROUAIX, PASTOR. **Descripción de una parte de la Sierra Madre en el Estado de Durango desde los limites de Chihuahua hasta el paralelo 24.** *Bol. Soc. Mexicana de Geogr. y Estadística*, Vol. 7, 1918, No. 9, pp. 551-565. Mexico.

SALINAS, MIGUEL. **El río de Yautepec.** *Bol. Soc. Mexicana de Geogr. y Estadística*, Vol. 7, 1918, No. 8, pp. 385-389. Mexico.

TALBOT, E. H. **Present conditions and the outlook in Mexico.** *Journ. of Race Devel.*, Vol. 9, 1919, No. 4, pp. 344-361. Worcester, Mass.

UGALDE, JOSÉ. **Las inundaciones en el Estado de Tabasco.** *Bol. Soc. Mexicana de Geogr. y Estadística*, Vol. 7, 1918, No. 8, pp. 391-396. Mexico.

SOUTH AMERICA

PARAGUAY, URUGUAY, ARGENTINA, CHILE

OJEDA, L. T. **Formación de la raza chilena.** *Rev. Chilena de Hist. y Geogr.*, Vol. 26, 1918, No. 2, pp. 76-89. Santiago de Chile.

OJEDA, T. T. **Cuestiones de geografía austral de Chile: I, El istmo de Ofqui; II, Límites de Llanquihue, Chiloé, y territorio de Magallanes.** *Rev. Chilena de Hist. y Geogr.*, Vol. 25, 1918, No. 1, pp. 161-217. Santiago de Chile. [An account of explorations in the south of Chile and the interprovincial boundaries in that region.]

ORMEZZANO, VINCENZO. **Le comunicazioni fra l'Italia e il Cile.** *La Geografia*, Vol. 5, 1917, No. 2, pp. 63-68. Novara.

OUTES, F. F. **Nuevos rastros de la cultura Guaraní en la cuenca del Paraná inferior.** Ills. *Anal. Soc. Científica Argentina*, Vol. 85, 1918, No. 3-4, pp. 153-182. Buenos Aires.

—— **Paraguay: General descriptive data.** 31 pp.; ills. Pan American Union, Washington, D. C., 1916.

PARDO, DENIS. **Territoire National de los Andes, Puna de Atacama.** *Atti X Congr. Internaz. di Geogr., Roma, 1913*, pp. 1245-1298. Reale Società Geografica, Rome, 1915. [A useful study of a region on which geographical literature is scanty. From the economic standpoint the region is, or rather will become, important on account of its mineral wealth—borate, sulphur, silver, and copper.]

RASSMUSS, JUAN. **Investigación de la extructura tectónica de la cuenca imbrífera del Río de la Rioja con motivo de la diminución del caudal de dicho río.** 20 pp.; diagrs., ills. *Direcc. Gen. de Minas, Geol. e Hidrol. Bol. No. 17, Ser. B (Geol.)*. Minist. de Agric., Buenos Aires, 1918.

ROMERO, A. A. **El homo pampaeus: Contribución al estudio del origen y antigüedad de la raza humana en Sud América según recientes descubrimientos.** Ills. *Anal. Soc. Científica Argentina*, Vol. 86, 1918, No. 1-2, pp. 5-48. Buenos Aires.

—— **Santiago, Observaciones meteorológicas en 1911-1915, (resúmenes).** Introduction by Carlos Henriquez. 50 pp.; diagrs. *Inst. Meteorol. y Geofísico de Chile Sección Meteorol. [Publ.] No. 21.* Santiago de Chile, 1917.

SOBRAL, J. M. **Estudio petrográfico de algunas rocas argentinas.** 54 pp.; ills. *Anal. Minist. de Agric.: Sección Geol., Mineral. y Mineria*, Vol. 13, No. 2. Direcc. Gen. de Minas, Geol. e Hidrol., Buenos Aires, 1918.

UHLE, MAX. **Fundamentos étnicos de la región de Arica y Tacna.** Ills. *Bol. Soc. Ecuatoriana de Estudios Hist. Amer.*, Vol. 2, 1919, No. 4, pp. 1-37. Quito.

UHLE, MAX. **Los aborígenes de Arica y el hombre americano.** *Rev. Chilena de Hist. y Geogr.*, Vol. 27, 1918, No. 3, pp. 33-54. Santiago de Chile.

—— **Uruguay: General descriptive data.** 31 pp.; ills. Pan American Union, Washington, D. C., 1916.

WAGEMANN, ERNST. **Die Wirtschaftsverfassung der Republik Chile.** viii and 253 pp.; bibliogr. Duncker & Humblot, Munich and Leipzig, 1913. M. 6. 10 x 7.

WICHMANN, RICARDO. **Geología e hidrogeología de Bahía Blanca y sus alrededores (Provincia de Buenos Aires).** 67 pp.; map, ills. *Anal. Minist. de Agric.: Sección Geol., Mineral. y Mineria*, Vol. 13, No. 1. Direcc. Gen. de Minas, Geol. e Hidrol., Buenos Aires, 1918.

WINDHAUSEN, A. **The problem of the Cretaceous-Tertiary boundary in South America and the stratigraphic position of the San Jorge-formation in Patagonia.** Maps, diagr. *Amer. Journ. of Sci.*, No. 265, Vol. 45, 1918, pp. 1-53.

—— ***Argentina, Mapa geológico-económico de la República. Hoja 35 m (Bahía-Blanca).*** 1:200 000. [In three sheets:] (1) ***Geología;*** (2) ***Topografía*** [relief in contours; intervals seemingly 6¼ meters]; (3) ***Datos complementarios*** [containing data on water

supply and soils]. Minist. de Agric., Direcc. Gen. de Minas, Geol. e Hidrol., Buenos Aires, 1916.

LUDWIG, PABLO. ***Nuevo Mapa de la República Argentina y sus paises limitrofes Chile, Uruguay, y Paraguay.*** 1:4,000,000. Pablo Ludwig, Buenos Aires, 1916. [Good reference map. Relief in brown shading. Provinces, etc., prominently colored.]

EUROPE

GENERAL

—— **Baltic Provinces and Lithuania, The peoples of the.** Map. *The Round Table*, No. 30, March, 1918, pp. 293-307. London.

BERET, GEORGES. **Autour d'une mer: La question de l'Adriatique.** *Colonies et Marine*, Vol. 3, 1919, No. 1, pp. 19-32. Paris.

COLE, G. A. J. **The narrow seas and the Arctic route to Muscovy.** *Geogr. Teacher*, No. 53, Vol. 10, Part I, 1919, pp. 4-8. London.

DEMORLAINE, J. **Strategic importance of forests in the war.** Translated by S. T. Dana from *Rev. des Eaux et Forêts*, February, 1919, and revised to date by P. S. Ridsdale. Ills. *Amer. Forestry*, No. 305, Vol. 25, 1919, May, pp. 1040-1043. Washington, D. C.

HANNAY, H. B. **European and other race origins.** XXXV and 491 pp.; maps, bibliogr., index. Sampson Low, Marston & Co., Ltd., London, 1915(?) 9 x 6.

LINGELBACH, W. E. **Geographic factors in the world war.** *Bull. Geogr. Soc. of Philadelphia*, Vol. 16, 1918, No. 4, pp. 126-139.

LOUIS, H. **Mineral production in relation to the peace treaty.** *Nature*, No. 2585, Vol. 103, 1919, May 15, pp. 205-206. London.

MEILLET, A. **Les langues dans le bassin de la mer Baltique.** *Scientia*, Vol. 24, 1918, pp. 383-392. Bologna.

NITSCH, CASIMIR. **Frontières linguistiques polono-tchèque et polono-slovaque.** *Le Moniteur Polonais*, No. 18, 1919, February 15, pp. 374-379. Bern.

RONCAGLI, GIOVANNI. **Physical and strategic geography of the Adriatic.** Maps, ills. *Geogr. Journ.*, Vol. 53, 1919, No. 4, pp. 209-228 (discussion, pp. 223-228).

RUBICON [pseud.]. **Czecho-Slovak claims.** Maps. *The New Europe*, No. 128, Vol. 10, 1919, March 27, pp. 247-251; No. 129, April 3, pp. 275-280; No. 130, April 10, pp. 304-309. London.

—— **Ruthénie-Blanche, Les problèmes politiques en.** Map. *Le Moniteur Polonais*, No. 16, 1919, January 15, pp. 340-346. Bern.

SAVIČ, V. R. **South-Eastern Europe: The main problem of the present world struggle.** Introduction by Nicholas Murray Butler. 276 pp.; map, ill., index. Fleming H. Revell Co., New York, 1918. $1.50. 8½ x 5½.

WINTERBOTHAM, H. S. L. **British survey on the western front.** Maps, ill. *Geogr. Journ.*, Vol. 53, 1919, No. 4, pp. 253-276 (discussion, pp. 271-276). [Tells in some detail of the work accomplished by the Allied surveyors in the preparation of large-scale maps made necessary by "a war of positions."]

—— ***Europe, 1: 1,000,000.*** Sheets. *North*: (1) ***L 30, Bordeaux***; (2) ***L 37, Rostov***; (3) ***M 29, Cork***; (4) ***M 37, Kharkov***; (5) ***N 37, Moskva (Moscow)***; (6) ***O 29, Stornoway***; (7) ***O 30, Aberdeen***; (8) ***O 31, Stavanger***; (9) ***O 32 and part of O 31, Kristiania and part of Stavanger***; (10) ***O 37, Yaroslavl***; (11) ***O 38, Nijni Novgorod***; (12) ***P 29 and 30, Thorshavn and Lerwick***; (13) ***P 31 and 32, Bergen and Trondhjem***; (14) ***P 37 and 38, Kargopol and Ustyug***; (15) ***Q 33 and 34 and part of 32, Bodö and Luleå and part of Namsos***; (16) ***Q 37 and 38, Arkhangelsk and Mezen***; (17) ***R 37 and 38, Rinda and Kanin.*** (All except L 30, L 37, M 37, N 37, are provisional editions.) *Geogr. Sect., Genl. Staff [Map] No. 2758.* Ordnance Survey Office, Southampton, 1917-1918. [Drainage in blue, relief in brown contours, railroads and names in black, roads in red.]

GROSS, ALEXANDER. ***The Daily Telegraph map No. 25: Races of Eastern Europe.*** [1:2,000,000.] "Geographia" Ltd., London, 1917(?) [Good general map. Could be used effectively as a wall map because of its large scale and contrasting colors. In the Balkans, the Serbo-Bulgarian ethnic frontier is shown to lie east of the political frontier, and the Macedonian Slavs are, with Cvijić, treated as a separate unit. The separation

of Ruthenians and Little Russians, especially by so contrasting colors as those used, is unfortunate. The distinction of the Maltese as a separate ethnic unit seems like overdoing the point.]

GROSS, ALEXANDER. ***The Daily Telegraph war map No. 29: "The German Peace."*** [1:2,000,000.] "Geographia" Ltd., London, [1918.] [Shows new boundaries as defined by the Treaty of Brest Litovsk, March 3, 1918, and the Treaty of Bucharest, June 12, 1918.]

GROSS, ALEXANDER. ***The Daily Telegraph gazetteer war map No. 4.*** Compiled from official sources. [1:633,600.] "Geographia" Ltd., London, [1918.] [Shows battle line on June 30, 1916, March 21, June 30, and Nov. 11, 1918; also armistice frontier and neutral zone.]

—— ***Western Front, The Allies' map of the: A detailed reference map, Paris to the Rhine.*** 1:475,000 (7½ miles to 1 inch). George Philip & Son, Ltd., [1918.] [Good map, general and yet sufficiently detailed, to follow the military campaigns on the western front. The following battle lines are shown in red: (1) extreme limit of German advance, Sept. 5, 1914; (2) battle front of July 1, 1916; (3) battle front of March 20, 1918; (4) limit of German advance to July 18, 1918; (5) limit of Allies' advance to Oct. 23, 1918.]

RUSSIA

FUNCK-MISOUTCH, M. R. **Le ricchezze minerali della Russia.** *La Geografia*, Vol. 6, 1918, No. 2, pp. 82-88. Novara.

LEVASSEUR, N. **Choses de Russie.** *Bull. Soc. de Géogr. de Québec*, Vol. 12, 1918, No. 4, pp. 217-221.

MARCHANT, F. P. **The Cecho-Slovaks in Russia and the British Declaration.** *Asiatic Rev.*, No. 40, Vol. 14, N. S., 1918, Oct., pp. 437-448. London.

WINTER, N. O. **The Ukraine, past and present.** Ills. *Natl. Geogr. Mag.*, Vol. 34, 1918, No. 2, pp. 114-128.

—— ***European Russia, Railway map of.*** In 2 sheets. [1:2,500,000.] R. Martens & Co., New York. 1919. [Valuable map based on the official Russian railroad map showing the names of practically all stations. The system of transliteration is not adjusted to English usage throughout; for instance the full "u" sound is rendered by the French equivalent "ou."]

—— ***Ukraine and the contiguous countries, General physical chart of the.*** [1:5,000,000.] Svoboda, Jersey City, [1918]. [Relief in very fair hachuring in brown and seven altitude tints. Exceptionally good for a wax-engraved map.]

AUSTRIA-HUNGARY*

DAINELLI, GIOTTO. **La popolazione di Fiume.** *Riv. Geogr. Italiana*, Vol. 26, 1919, No. 1-4, pp. 28-46. Florence.

EREDIA, FILIPPO. **Il clima di Gorizia nel quarantacinquennio 1870-1914.** 11 pp. Reprint from *Boll. Bimensuale Soc. Meteorol. Italiana*, 1917, No. 6-9. Turin.

LAENG, GUALTIERO. **Il Carso: Geografia, geologia, paesaggio e vegetazione, doline, grotte e abissi, idrologia sotterranea.** Maps, diagrs., ills. *Riv. Mensile Club Alpino Italiano*, Vol. 36, 1917, No. 8-9-10, pp. 190-197; No. 11-12, pp. 233-246. Turin.

BARATTA, MARIO. ***Carta del grande altopiano della Carsia Giulia (Carso triestino-gorizsiano).*** 1:100,000. [With 24 pp. of text.] Inset: Gli altipiani della Carsia, 1:500,000. Istituto Geografico De Agostini, Novara, 1918. L. 2.50. [Admirable map, showing relief in shading and contours, with the lowlands tinted green. An inset, 1:500,000, shows the plateaus of the Karst, distinguishing between the limestone uplands and the alluvial lowlands.]

ASIA

TURKEY IN ASIA, ARABIA, CAUCASIA, IRAN

BERNARD, AUGUSTIN. **La Syrie et les Syriens.** *Ann. de Géogr.*, No. 151, Vol. 28, 1919, pp. 33-51.

BERTACCHI, COSIMO. **L'Armenia.** 24 pp.; map, ills., bibliogr. *Quaderni Geografici*, Vol. 1, 1918, No. 2. Istituto Geografico de Agostini, Novara, 1918.

* Pending the final settlements, the political divisions of 1914 will be retained.—EDIT. NOTE.

CARRUTHERS, DOUGLAS. **The great desert caravan route, Aleppo to Basra.** Map. *Geogr. Journ.*, Vol. 52, 1918, No. 3, pp. 157-184.

HOLDICH, THOMAS. **Bagdad.** *Journ. Central Asian Soc.*, Vol. 4, 1917, Part II, pp. 40-55 (discussion, pp. 49-55). [London.]

—— **Palestine and Jewish nationalism.** *The Round Table*, No. 30, March, 1918, pp. 308-336. London.

PEARS, EDWIN. **Turkey, the war, and climatic influences in Asia Minor.** *Journ. Central Asian Soc.*, Vol. 2, 1915, Part III, pp. 97-112 (discussion, pp. 108-112). [London.]

PICHERY, P. **La question d'Asie-Mineure.** Map. *Colonies et Marine*, Vol. 3, 1919, No. 4, pp. 241-247. Paris.

TAYLOR, A. B. **The River Tigris from the sea to Baghdad.** *Journ. Central Asian Soc.*, Vol. 4, 1917, Part III, pp. 72-89 (discussion, pp. 87-89). [London.]

—— **Turkey: A past and a future.** Reprinted (with additions) from *The Round Table*, for June, 1917. 79 pp.; maps. Hodder & Stoughton, London, 1917. 9½ x 6.

—— ***Armenia, The seat of war in.*** (Stanford's War Maps, No. 10.) 1:1,000,000, or 1 inch to 15.78 miles. Edward Stanford, Ltd., London, 1915. [Map on relatively large scale; relief in brown shading.]

CHINA

CARACI, GIUSEPPE. **Il padre Matteo Ricci e le carte speciali della Cina nelle collezioni di Ortelio e di Mercatore.** *Boll. Reale Soc. Geogr. Italiana*, Vol. 7, 1918, No. 11-12, pp. 845-851. Rome.

CHAPMAN, H. H. **Forests and floods in China.** Ills. *Amer. Forestry*, No. 302, Vol. 25, 1919, February, pp. 835-843. Washington, D. C.

CHENG, SHI-GUNG. **China's geography: Historical and social.** Map, ills. *Scottish Geogr. Mag.*, Vol. 34, 1918, No. 8, pp. 281-294.

—— ***China, Postal map of.*** (Enclosure to "Report on the Working of the Chinese Post Office" for the Sixth Year of Chung-Hua Min-Kuo (1917) and 7th issue of The Postal Guide.) 1:2,400,000. Directorate General of Posts, Shanghai, 1917. 50 cents. [Shows postal routes in detail, those established in 1917 being differentiated in red.]

—— ***Kiangsu District, Postal route map of.*** [1:1,400,000.] Corrected to December 31, 1917. [In English and Chinese.] [Postal Commissioner's Office, Nanking, 1918.]

TEICHMAN, ERIC. ***China: Map showing routes in the province of Shensi.*** 1:2,000,000. Accompanying the author's article "Notes on a Journey Through Shensi," *Geogr. Journ.*, Vol. 52, 1918, No. 6.

WORLD AS A WHOLE AND LARGER PARTS

WATSON, MALCOLM. **Rural sanitation in the tropics: Being notes and observations in the Malay Archipelago, Panama, and other lands.** xvi and 320 pp.; maps, diagrs., ills. John Murray, London, 1915. 12s. 9 x 6.

Long experience in the Malay Peninsula, both in government work and in the sanitation of private estates, has given Dr. Watson a thorough knowledge not only of malaria, but of how to prevent it. Wide travel has broadened his perspective so that he views his problem as part of the greater problem of the uplifting of the tropics. Although nearly two-thirds of his book is devoted to details of the familiar story of the preventive measures employed at Panama, the most valuable parts deal with neighboring regions and with Malaya. A short section on British Guiana states that in many districts "the infantile mortality is so high that the negro population is actually decreasing. The high infantile death rate is indeed the negro's chief asset. It keeps wages so high that if he works for a day he can retire to his hut for a week." Barbados receives attention as an example of a tropical region without malaria. Dr. Watson, on apparently good grounds, rejects the usual view that mosquitoes are absent because the larvae are eaten by a small minnow called the "millions." He attributes the island's immunity to its geological structure as a coral reef. He might have strengthened his argument by stating that the Bahamas, which are likewise composed of recently uplifted coral limestone, are almost free from malaria. In both cases the limestone is so porous that there is practically no standing water. Hence no breeding places for mosquitoes.

The most interesting part of Dr. Watson's book is the first one hundred pages where he describes his own experience in British Malaya. Few people realize the wonderful progress that has been made in the prevention of malaria on tropical plantations. Everyone is familiar with what has been achieved in Panama, but that is a highly specialized case where large numbers of people are gathered in a small area, where the government has complete and easy control, and where large amounts of money have been freely spent. On isolated plantations, however, where native labor is being employed to raise rubber, cacao, bananas, and other tropical products, the prospects have appeared by no means so bright. Nevertheless Dr. Watson shows that in Malaya it has been possible almost entirely to eradicate malaria in the level lowlands by the simple expedient of careful ditching and drainage. At first quinine was administered as a preventive, houses were screened, and other methods such as oiling the pools were tried, but it was soon found that drainage alone is sufficient. The only requisites are that the drains extend to a distance of 2,000 feet or so from the dwellings, that they be dug so that the water keeps slowly in motion, and that weeds and materials on which the mosquitoes can breed be carefully cleaned out. Under such conditions even the careless natives enjoy almost complete immunity except when they go out into surrounding districts where malaria still prevails.

Contrary to the general belief the elimination of malaria in many tropical regions is much harder among the hills than in the swamps. The ordinary view of the matter is based on conditions in regions like Italy where the malarial mosquitoes are confined to the lowlands. In southeastern Asia, however, including India, the Malay Peninsula, and some of the neighboring islands several kinds of malarial mosquitoes live in the clear running streams of the mountains. Attempts to get rid of them by cleaning out the streams so that there are no grasses, sticks, or protected places on which the larvae may lodge have proved sadly ineffective. Dr. Watson discovered that this is because even in swiftly running water the larvae of these species can cling to rocks or other hard substances and thus breed in streams of crystal clearness and purity. Among the hills, therefore, he promptly put all the water underground in closed drains. Thus highland plantations have been rendered as safe as those of the lowlands, and death rates reduced to one-tenth of what they were.

Dr. Watson's investigations seem also to indicate that slight changes in the chemical composition of the water are enough to drive away one species of mosquitoes or another. Thus it may be possible to employ still another method in improving the health of the tropics. Furthermore, the author describes many instances where the thorough cultivation of the land has largely eliminated malaria. Where all the land is well tilled there is little room for stagnant water. Thus in one way or another there is hope not only for the towns of tropical regions, but for the plantations, whose cultivation must form the basis of any real progress. By a combination of sound engineering work with brilliant scientific speculation Dr. Watson has put himself among the leaders in the regeneration of the vast regions cursed by malaria. Large parts of his book record his observations with an almost unnecessary degree of minuteness. Nevertheless its many pages of admirable exposition, its descriptions, such as that of fortunate non-malarial Sumatra, and its earnest, open-minded spirit commend it to all who are interested in the lands within thirty degrees of the equator.

ELLSWORTH HUNTINGTON

MATHEMATICAL GEOGRAPHY

CARTOGRAPHY

BREMNER, ALEXANDER. **A new medium for the construction of geographical models.** Diagrs. *Scottish Geogr. Mag.*, Vol. 34, 1918, No. 9, pp. 342-350. [Molders' sand.]

BROWN, ROBERT M. **Making wall maps of limited areas.** Maps. *School Sci. and Math.*, Vol. 18, 1918, No. 5, pp. 397-400. Chicago.

DE MARCHI, LUIGI. **La rappresentazione della superficie terrestre.** *Scientia*, Vol. 25, 1919, pp. 186-195. Bologna. [A discussion of the best projection methods for the various kinds of mapping.]

PHYSICAL GEOGRAPHY

METEOROLOGY AND CLIMATOLOGY

(1) —— **Barometer manual for the use of seamen, A: A text-book of marine meteorology.** 8th edit. 106 pp.; maps, diagrs., ills., index. *M[eteorol]. O[ffice Publ. No]. 61.* Meteorological Office, London, 1916. 1s.

(2) —— **Seaman's handbook of meteorology, The: A companion to the barometer manual for the use of seamen.** 3rd edit. xxxviii and 202 pp.; maps, diagrs., ills., index. *M[eteorol]. O[ffice Publ. No]. #15.* Meteorological Office, London, 1918. 3s. 6d.

(3) —— **Marine observer's handbook, The.** 2nd edit. iv and 142 pp.; diagrs., ills., index. *M[eteorol]. O[ffice Publ. No]. #18.* Meteorological Office, London, 1918. 3s. 6d.

The British Meteorological Office issues a large series of important publications which are by no means so well known, or so widely used, in this country as they deserve to be. This regrettable situation is doubtless due in part to the fact that these volumes are not generally advertised and in part to the fact that many teachers and students who would naturally buy them are under the mistaken impression that all these publications are either highly technical or else are of interest to British readers, and especially to British seamen, only. This is far from being the case. Several of them are of value to every teacher and student of meteorology in the United States. Furthermore, the low price at which these volumes are sold is another reason why they should be widely known in our own country.

(1) The "Barometer Manual for the Use of Seamen" is historically an interesting volume, for it is the lineal successor of the barometer manual originally prepared by Admiral Fitzroy. It was first published in 1884 as a revised edition of Fitzroy's book and has been through seven editions, the present issue being the eighth. In all, about 35,000 copies of the work have been distributed. As its title implies, it deals chiefly with the barometer and the method of using it; with pressure and its variations; with the causes and distribution of winds; and with storms and gales in both tropical and extratropical latitudes. The descriptions and explanations are simple, clear, and direct. Excellent charts and numerous figures illustrate the most important topics. One of its most valuable portions is a new introduction, setting forth the most modern views of the structure of the atmosphere and the relation existing between pressure distribution, upper currents, and surface winds. These subjects are not naturally easy for the ordinary reader to understand, but the discussion is admirably clear, and the 25 pages of this introduction might well be included in any modern textbook of meteorology. The rapid progress of the new meteorology may be seen in the free use of such terms as "cyclostrophic" and "geostrophic" motion and "katabatic" and "anabatic" winds. The introduction of the new C. G. S. units of pressure and of absolute temperatures is another sign of recent advance, but the older units (inches, hundredths, Fahrenheit degrees) are also included. Furthermore, the general introduction of wireless telegraphy and the possibility of constructing daily weather maps on board vessels at sea, have led to the addition of an appendix containing instructions regarding the transmission of daily meteorological information by wireless from the Eiffel Tower. The two weather charts (Pl. 34), prepared from messages issued by radiotelegraphy from the Eiffel Tower, are in themselves well worth the extremely low price of the manual. The volume is really a historical one, giving the facts of the general atmospheric circulation as far as these are known from observations at sea. But, to quote (p. 25), "the time has now arrived when seamen *who are interested in meteorology, as well as the weather* [the italics are ours] may be interested to see the direction in which scientific investigation is leading." The book itself may be considered as introductory to the Introduction, "but the facts are still the most important feature, and their representation is still the main purpose of the book."

(2) "The Seaman's Handbook of Meteorology" is more general in character. It is intended for the ocean-going sailor who needs to know the rudiments of meteorology in order to make the most intelligent use of the "Barometer Manual." Emphasis is laid first upon the individual weather elements and then upon weather and upon forecasting, both by weather maps and by observations at a single station, as on board ship. In the discussion of forecasting, of weather types, and of the conditions which bring gales and fog the British Isles and their adjacent water areas are chiefly considered; but much of the very useful and practical information contained in these chapters applies, with slight modifications, to the North Atlantic steamer routes. A chapter on icebergs and other forms of drifting ice is included because of the obvious importance of this subject in navigation and because of the connection which exists between meteorological conditions and the amount and drift of ice at sea. There are also a chapter on instruments and their use, an appendix on the mirage and its effects in causing displacements of the apparent sea horizon, and a general preface by Sir Napier Shaw. The text is by Commander M. W. Campbell Hepworth, Marine Superintendent of the Meteorological Office. Type weather maps, ice charts, cloud views, and other illustrations are included.

The passing of the sailing vessel with the increasing use of steam does not mean that meteorological conditions no longer need consideration in ocean navigation. Far from it. Wind, fog, floating ice, and snow still are, and will always remain, of critical importance to seamen. The ocean liner which steams ahead through a fog is in greater danger of collision with another vessel or with an iceberg than is the sailing ship, which under such conditions is either becalmed or is moving but slowly. And, whatever else may be said, it remains true that "whatever be the size or power of an ocean-going vessel, her success as a dividend-earner depends upon taking advantage of all circumstances, including the weather."

(3) As its title indicates, "The Marine Observer's Handbook" is a complete set of instructions for the use of captains and officers of vessels conducting observations for the British Meteorological Office. It therefore has special reference to the form of meteorological log which is supplied to British ships. There are, nevertheless, several matters in it which have a general interest, such, e. g., as the difficult problem of the proper exposure of a rain gage at sea and the discussion of waves and swell and optical phenomena.

These three publications, while not designed for use on land or in general meteorological instruction, all contain much of interest and value to any student of meteorology.

R. DEC. WARD

PAINE, G. P. **Report on modes of air motion and the equations of the general circulation of the earth's atmosphere.** Diagrs., bibliogr. *Monthly Weather Rev.*, Vol. 46, 1918, No. 7, pp. 311-323. Washington, D. C.

It takes a mathematical physicist to appreciate fully the value of this paper, the object of which "is to classify and to analyze fundamental modes of air motion and to ascertain some of the mathematical laws governing general circulation, a particular mode of motion in the earth's atmosphere."

"The reason for the apparent failure of the kinetic theory of gases to account for observed air motions is to be found in the fact that the classical equations apply to the instantaneous air drift out of one fixed, microscopic volume element into another, while the motions that actually come under observation are in general of another and fundamentally different mode.

"With a view to removing this difficulty, air motions are classified [and discussed mathematically in detail] in terms of mass motion, molecular motion, winds, and turbulence. Winds are classified with reference to their order [i. e. unit of time used]; and turbulent motions, with reference to their order and to their kind. * * *

"Varied and in some respects conflicting as the data seem to be, the following generalizations seem to have been empirically established. (*a*) Turbulence of the kind under consideration appears in the neighborhood of obstacles, material boundaries and surfaces of discontinuity, and in general where high differential velocities exist between adjacent fluid strata. (*b*) It may appear where the material boundaries and the adjacent fluid strata are at the same temperature. (*c*) A wind of order T [time unit] is in general modified profoundly by the occurrence of superimposed gusts, cross-currents, and eddies—turbulent motions relative to T. In particular, a turbulent wind does not obey the laws * * * governing the mass motion of the gas. On account of the first two of the foregoing generalizations, the kind of turbulence under consideration will be referred to as *kinetic turbulence.* * * *

"*Convective turbulence.* A stream of water at 20° C. and flowing rapidly down an inclined iron trough at the same temperature will exhibit turbulence relative to a general drift corresponding, say, to hourly means. If the temperature of the trough be sufficiently increased, the water will boil as it descends, and the turbulence will thus be enormously complicated by the appearance of a new type of stream-line irregularities. Such irregularities, which are due to temperature differences between material boundaries and their adjacent fluid strata, occur in the lower layers of the atmosphere and operate powerfully to modify atmospheric stream lines. On a fair summer day the process is generally visible. During the morning, the earth becomes hotter than the adjacent air, and heat is conducted from the ground to the lowest air stratum. The resulting vertical instability manifests itself in multitudinous flickering jets rising from the ground. Although these jets are visible only to the height of a few feet, the appearance of cumulus clouds bears witness to the fact that the jets are uniting into massive convection columns which are driven upward to an altitude of perhaps a mile. The structure of higher-order surface winds is profoundly complicated by these enormous air columns cutting across their lines of flow. Relatively lacking in momentum, the ascending masses mix with the currents of the upper air, while irregular downward draughts, replacing the thermally driven masses and transmitting horizontal momentum from the upper air currents to the surface layers, unite into a wind of

higher order near the ground, which, making itself first felt in the morning, attains a maximum velocity during the day and disappears during the late hours of the afternoon.

"This mode of motion, *convective turbulence*, is characteristic of regions where the material boundaries and the adjacent air strata are at different temperatures. It accordingly differs essentially from kinetic turbulence with regard to its origin; possibly also with regard to characteristic stream-line configurations. * * *

"But in the results of observation there is generally little or nothing to enable one to distinguish between kinetic and convective turbulence. Near the earth the two phenomena combine to the extent that the atmosphere has well been called a 'treacherous sea,' where irregular cross currents and eddies, violent swirls, and sudden side gusts prevail."

At the end of the paper there is a bibliography of 104 references to contributions by 80 different authors.

CHARLES F. BROOKS

SHAW, NAPIER. **The weather map: An introduction to modern meteorology.** 4th issue. 109 pp.; maps, diagrs., index. *M[eteorol]. O[ffice Publ. No]. 225 i.* London, 1918. 4d.

—— **Meteorological glossary, in continuation of "The Weather Map" (M. O. 225 i).** 4th issue. 358 pp.; maps, diagrs., ills. *M[eteorol]. O[ffice Publ. No]. 225 ii.* London, 1918. 1s.

To write "an introduction to modern meteorology" within less than 50 pages of a small-sized book costing but fourpence would seem an impossible task. But Sir Napier Shaw has done it and done it well. "The Weather Map" has a distinct war bearing, as is seen in the opening paragraphs on meteorology and military operations; in the section on the meteorologist at the headquarters of a modern army; and in the climatic summaries for London, Paris, Philippopoli (Balkans), Babylon (Mesopotamia), Helwan Observatory (Egypt), and Dar es Salam (East Africa). But the little volume has a more permanent interest than that associated with the war. It presents some of the fundamental facts of modern meteorology in so clear, so concise, and so simple a way that it is not only interesting reading but is highly instructive as well.

About half of the volume is devoted to the climatic summaries for one station in each of the principal British war areas, illustrated by a series of excellent charts and diagrams. Several maps illustrate typical weather conditions of the British Isles.

It is not often possible to say, with truth, that a book is absolutely indispensable to a worker in any department of science. Such a statement can, however, be made of the "Meteorological Glossary" and without fear of contradiction. We have here, closely packed into about 350 pages, explanations of technical terms which are in more or less frequent use by meteorologists—explanations often so complete that they suffice for all purposes of ordinary teaching or study. The "Glossary" is stated to be a continuation of "The Weather Map" referred to above, but it has a far wider range of usefulness than that statement implies. It is true that cross references in the "Glossary" make it highly desirable for those who use it to have also copies of "The Weather Map", as well as of the "Observer's Handbook" and of the "Computer's Handbook", all issued by the Meteorological Office. But the "Glossary" is absolutely indispensable even without those additional volumes and should henceforth be on the desk of every meteorological worker. The discussions were written by experts connected with the British Meteorological Office; the revision of the work for the present fourth issue was carried out by Dr. C. Chree, F.R.S., Superintendent of the Kew Observatory, and the direction of the whole undertaking was in the hands of Sir Napier Shaw. No more than that need be said to establish the fact that the work is authoritative, up to date, and complete. It is hardly necessary to select any sections for special mention, but attention may perhaps be called to the present interest of the discussions of airplane weather, the new pressure units, harmonic analysis, and wireless telegraphy in relation to meteorology. Meteorologists the world over are indebted to the British Meteorological Office for many valuable publications, but the new issue of the "Glossary" is distinctly the most generally useful of all. It is the working meteorologist's absolutely indispensable *vade mecum*.

R. DEC. WARD

DINES, W. H. **Meteorology in relation to aeronautics: A review of the data required by an aviator when in the air.** Diagrs. *Scientific American Suppl.*, No. 2239, Vol. 86, 1918, November 30, pp. 351-352; No. 2240, December 7, pp. 366-368. ["A paper read before the Aeronautical Society of Great Britain, and published in the *Aeronautical Journal.*"]

GUILBERT, GABRIEL. **Sur la prévision des variations barométriques.** *Comptes Rendus de l'Acad. des Sci. [de Paris]*, Vol. 168, 1919, No. 18, pp. 899-902.